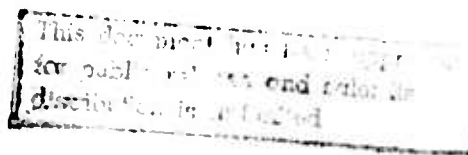
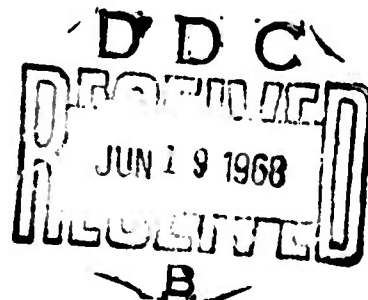


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CONTRACTOR SUPPORT OF FIXED
AND ROTARY WING AIRCRAFT
WEAPON SYSTEMS

TASK 68-2

APRIL 1968



LOGISTICS MANAGEMENT INSTITUTE
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Washington, D. C. 20016

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April 1968

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I. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The major objective of the task is to evaluate current practices in the military departments which are applied in making contractor vs. military support decisions and to recommend a "best" method compatible with the peculiarities of mission requirements. Using three fixed wing and three rotary wing aircraft weapon systems as case studies, the practices utilized by the Army, Navy, and Air Force were analyzed, compared, and evaluated with the initial expectation that a "best" method could be identified and recommended. Support plans which had been prepared for those weapon systems, both by contractors and by the services, were studied. Also studied were numerous policy and procedural guidance documents pertinent to support planning as well as several proposals and contracts for support to be provided by contractors.

Our findings indicate that there are elements of support which under certain conditions can be provided by contractor sources more effectively than by organic sources. Conversely, the same elements of support under different conditions might better be provided by organic sources. Therefore, the selection of the most appropriate source with respect to any element or group of elements of support should be made on the basis of a cost-effectiveness analysis applied on a case-by-case basis. There are two critical areas which must be considered above the economics associated with various support options:

1. Ability to effectively sustain the system operation.
2. Quality of support.

The first critical area includes consideration, with respect to various support options, of such things as system downtime, system mobility, critical skills required at the operational level, and control over the support operation. The second critical area is concerned with the relative quality of the support being considered if provided by various sources.

While these critical areas are often considered broadly, with respect to contractor/organic support in general, they are not thoroughly assessed with respect to specific elements of support at specific levels of assembly. The result is that overall weapon system effectiveness is often degraded by ineffective support of subsystems or components comprising the weapon system.

Comparative analysis of the policy, procedural guidance, actual support plans, and contract specification revealed no significant differences among service practices for utilizing contractor support. On the other hand, our findings did indicate that there are several significant similar practices followed by all services which affect and often dictate the type and amount of contractor support utilized for any fixed or rotary wing aircraft. These are:

- 1) Each military service aims at having, as far as possible, a complete organic support capability in being when a new weapon system is first placed in the hands of the operational units.

While it is essential that selected support activities be provided from organic sources in order for a weapon system to be operationally effective, there are also certain support activities which can be provided from contractor sources. In fact, under some circumstances contractor support may enhance weapon system effectiveness. A goal

aimed at establishing complete organic support capability too soon can preclude attaining the most effective support.

- 2) An organic support target date is generally selected to coincide with delivery of production items to operational user.

The establishment of an organic support target date serves a useful purpose as a planning milestone, but in order to make most effective use of both contractor and organic capabilities, separate dates often need to be established for various different support activities. There is a tendency to make the phaseover a single, abrupt, and final step.

- 3) Each department interprets DoD policy to encourage, or at least permit without subjecting to either effectiveness or economic analyses, military support with respect to equipment considered "mission-essential."

When an item of equipment is determined to be "mission-essential," organic support is generally considered to be essential also. Such a general practice does not motivate an examination of contractor or interservice support options which may be more effective. When decisions related to support for non-mission-essential equipment are made, policy requires the use of comparative cost analyses.

- 4) Each department relies heavily on the contractor for support during the early design, development, and testing stage.

As a result of this practice, it is normal to find that a weapon system contractor will have developed a considerable support capacity which is needed to demonstrate supportability of the system and to provide support to the first production items. Thus, use of this contractor capability may

provide the best method of support in those areas of supply, maintenance, training and technical engineering services which have not yet been developed in the military departments.

- 5) Current OSD and department policy does not require a thorough examination of all contractor and interservice support options.

Unless all feasible support options are examined, there can be no assurance that the most effective support method is being used.

- 6) No department uses a uniform disciplined procedure to make comparative effectiveness and cost analyses among the alternatives of contractor or organically provided support, interservicing options, or the best mix of these options. The amount and kind of data required by recent acquisition contracts make such analyses feasible.

A uniform procedure for making comparative effectiveness and cost analyses will provide a "method" for measuring different support options, will conserve effort by limiting the number of analytical procedures in use and will improve chances of selecting the most cost-effective support method.

B. CONCLUSIONS

The study findings and analysis lead to three major conclusions.

Conclusion 1:

No service has developed a best method that can be recommended as a standard. Each service in attempting to achieve the goal of early support self-sufficiency fails to consider all feasible support options. The concept of requiring an organic support capability for equipment which is classified as mission-essential does not encourage

examination of any alternative non-organic support options.

Conclusion 2:

A general policy or rule regarding the type, amount, or duration of contractor support should not be established at this time.

Various weapons systems are technologically different; the nature of their missions and their operational environments are different; basic support concepts are different; development and deployment schedules are different; and the capability of contractors and the services to provide effective and economical support varies from system to system and from time to time. Moreover, there is no available source of thorough analyses which has examined the effects of contractor vs. organic support on mission-effectiveness, operational readiness and support costs. Therefore, no basis exists at this time for developing a general policy or rule concerning the best utilization of contractor support. This is not to say that some general policy or rule might not in the future be appropriate. To discover such a policy or rule requires a disciplined analytical approach on a case-by-case basis until such time as sufficient knowledge becomes available concerning the relative merits of contractor vs. organic support.

Conclusion 3:

An effective method for determining the use of contractor support is one which would take into consideration the following factors. First, and most important, is that it must assure that the mission-effectiveness of the equipment is enhanced and not degraded. Secondly, all feasible ways of providing the support should be identified and compared

for both effectiveness and costs. Third, the method should enable comparisons to be made within various options, such as competing contractors or among contractor vs. organic options. Fourth, the method should be useful to support managers at all levels of management, both in the services and in industry. Fifth, the method should be capable of application in conceptual studies, development plans, contractual documents and detailed plans. Sixth, the method should be simple and easy to apply in the decision-making process.

C. RECOMMENDATIONS

In response to the primary objectives of the task and in view of the study conclusions, a major effort was directed toward developing a methodology for evaluating various support options including contractor and inter-service support. The technique developed is presented in the report and includes a decision network and tradeoff models which place emphasis on the overall support effectiveness and operational readiness posture of the weapon system. Two recommendations are made:

Recommendation 1:

That a support planning technique such as the one proposed in this report be applied to several weapon systems during the early stages of development.

Recommendation 2:

That the results be monitored, and appropriate policy and procedural guidance based on these results be developed.

II. INTRODUCTION

A. BACKGROUND

The basic mission of the military departments is to develop, acquire, and maintain in a state of combat readiness those weapon systems and fighting forces necessary to assure the accomplishment of national objectives. Included in the basic mission is the requirement to support such systems and forces effectively and with reasonable economy, although the latter must necessarily be subordinate to the former. Pursuit of the mission requires the military departments to assess continually various sets of alternatives which are available with respect to the development and logistic support of major weapon systems. This study is directed toward one such set of alternatives--namely, contractor vs. military logistic support of military equipment.

The military departments have recognized for a long time that under certain conditions an advantage may result by relying on segments of private industry for logistic support of certain military equipments. Normally, such advantages are believed to be most prevalent during the development, test, and introductory phases¹ in a weapon system life cycle. Accordingly, when a new weapon system is under design, development, test and initial acquisition, the military departments frequently contract for initial support services with the design and development contractor.

¹The introductory phase of a weapon system life cycle is defined for purposes of this study to be that period of time between the delivery of the first contract end item of the weapon system and the last operational unit under the initial acquisition contract.

Not so frequently the military departments will contract for logistic support beyond the introductory phase.

The precise advantages of contractor vs. military support are undoubtedly peculiar to the particular weapon system considered. Peculiarities of the weapon system itself; the state of technology within which the weapon system is designed; the planned operational environment of the system; the design, development, and acquisition schedule; the support plan adopted; current support capability available in the military establishment; and the industrial resources available are all factors which contribute to the decisions of contractor vs. military support. Many such factors are dynamic -- changing with time or as a result of related decisions made by military or industry management. It is not unlikely, therefore, that many cases can be singled out, after the fact, that indicate but not necessarily prove an economic error with regard to the contractor vs. military support choice. Such cases only serve to demonstrate the complexity of the many related factors inherent in making the proper choice.

Support planning for any weapon system must place emphasis on system effectiveness in performance of the intended mission. Current Department of Defense policy and procedural directives clearly lay on the military departments the responsibility to support their deployed weapon systems. Choices, however, are available to decision makers among use of contractors, use of their own military facilities, and use of another department's facilities; but such choices are not obvious or easy ones to make.

Recognizing the complexity of the problem, the Assistant Secretary of Defense (Installations and Logistics) initiated this study as a step toward providing the military departments with improved policy and procedural guidance with regard to contractor vs. military support decisions.

B. OBJECTIVES AND SCOPE OF THE TASK

The major objective of the task is to analyze, compare and evaluate current practices utilized in the military departments in making contractor vs. military support decisions and to recommend a "best" method. The search for a "best" method is not intended to imply that the practices applied by one military department are necessarily superior and should, therefore, be imposed on the other departments. It is rather intended that a best method be considered in terms of incorporating the most effective techniques of each department with improved policy and procedural guidance for the purpose of strengthening the decision process in all departments.

In examining the contractor vs. military support decision process, "interservicing" is considered as an alternative method of military support. Interservicing is defined as the support by a single department,¹ of an item of equipment common to two or more military departments.

The scope of the task is limited for convenience of study to utilization of contractor support of fixed and rotary wing aircraft weapons systems during the test, evaluation and introductory phases.² Contractor support for weapon systems already deployed was not included in the scope of work and is therefore not directly addressed in this report. However, during the course of the study,

¹Also see definition, page 21.

²See footnote, page 7.

many similarities became apparent between already deployed and new systems regarding both economic and non-economic considerations for contractor support.

Implicit in this task is the assignment to recommend a way to improve the quality of decisions made regarding the use of the contractor and of interservicing in providing support to weapon systems being newly introduced into operational use. Explicitly, the task requires that LMI recommend a "best" method and in the process of doing so:

- (1) Identify the present procedures of the services for defining and utilizing contractor support.
- (2) Determine the availability of data useful in evaluating contractor support.
- (3) Compare the methods used by the services.
- (4) By trade-off analysis techniques, evaluate the various service methods and arrive at an optimal technique.

A copy of LMI's task order is included in the report as Exhibit I.

C. STUDY APPROACH

The study included four principal areas of effort:

- 1) Review and analysis of current practices, including Department of Defense policies and procedures, and the methods which are applied by the three military departments in making contractor vs. military support decisions.
- 2) Selection and analysis of several specific weapon systems as case studies.

- 3) Identification of major problem areas through analysis of the contractor vs. military support decision process and its interfaces with other related support decisions.
- 4) Synthesis and development of proposed solutions.

The study began with an examination of pertinent Federal Government and Department of Defense policy and procedural guidance. Next, policy and procedural documents at departmental levels were reviewed.¹ With these reviews as a background, specific cases were studied to determine how and with what techniques the policies and procedures were implemented.

Six aircraft weapon systems were studied -- three rotary wing systems, and three fixed-wing systems. The rotary-wing types are all Army helicopter systems and include the OH-6A, AH-56A, and the CH-47. The CH-47 has been in the Army inventory for several years. The OH-6A is a newer system currently in production, and is just being introduced into the Army operational inventory. At the time of the study only ten prototype AH-56A aircraft were being procured. These prototypes will be subjected to an extensive series of tests including an appraisal of various operational and field level support concepts. Such tests will be helpful in determining support requirements when full-scale production is initiated. Thus the three systems provide opportunities to examine a range of Army procedures for use of contractor support.

¹Exhibit II contains a partial listing of some of the more important documents which were reviewed and which have a direct bearing on the use of the contractor for support.

The fixed-wing systems selected include the F-111, the A-7, and the C-5A. The F-111 and the A-7 are both new systems used by more than one service and thus provide a basis for examining interservicing practices. The C-5A was examined principally because it was procured under a Total Package Procurement (TPP) concept. Inherent in the concept of such innovations as Total Package Procurement, Contract Definition, and Integrated Logistic Support Planning is a careful cost-effectiveness consideration of support procedures and practices.

Support plans prepared by contractors and military activities for the above-mentioned weapon systems were examined. In some cases special instructions have been issued concerning support planning,¹ and these were also examined. Interviews were held with personnel involved in planning and managing support activities in contractor organizations, Project Managers' organizations, and department logistics organizations.

A major part of the study effort included consideration of the interfaces between the contractor vs. military support decision and other related support decisions such as repair vs. discard and field maintenance vs. depot maintenance.

The final phase of the study effort was directed toward developing a proposed integrated support decision network intended as a guideline for the contractor in

¹Examples are the 6 May 1964 "Joint Air Force/Navy Guidance for Preparation of F-111 Integrated Support Plan" issued by ASN(I&L), and ASAF(I&L), the 15 December 1964 "Charter of the F-111 Weapon System Air Force and Navy Joint Planning and Scheduling Group."

making equipment support recommendations and as a method by which the military department can evaluate such recommendations. The proposed decision network is referred to as a "Support Planning Optimization Technique." Although the proposed technique includes some mathematical decision models, further refinement including detailed procedures for implementation is required.

III. FINDINGS AND ANALYSIS

A. ANALYSIS OF CONTRACTOR/MILITARY SUPPORT

1. Elements of Support

There is no standard description of support elements which should be considered for contractor/organic support decision. However, Department of Defense Directive 4100.35¹ defines Integrated Logistic Support as "a composite of the elements necessary to assure the effective and economical support of a system..."; and this same directive defines seven elements of integrated logistic support. The elements which are defined include maintenance planning, logistic support personnel, data and information, support equipment, spares and repair parts, facilities, and contractor-provided maintenance.

Any of the first six support elements described in DoD Directive 4100.35 could conceivably be provided from either contractor or military sources. Undoubtedly, other aggregations of activities could be compiled to identify either broader or more detailed support elements which could also be furnished by either contractor or military sources. A review of the support elements described in DoD Directive 4100.35 suggests that there are three principal areas of support -- Maintenance, Training, and Supply. Any of the various elements of support could reasonably be considered as a requirement for providing support in any one of these three principal areas. In other words the support of a weapon system is directed toward either maintaining the system, training personnel to maintain or operate the system, or providing the necessary material to maintain or operate the system.

¹Department of Defense Directive 4100.35, Subject: "Development of Integrated Logistic Support for Systems and Equipments," July 19, 1964.

There are many alternatives available in connection with contractor vs. military support. For example the contractor might provide all maintenance required for a particular weapon system while the military provides its own supply support as well as supply of repair parts to the contractor to facilitate maintenance. On the other hand, the contractor may be responsible for procuring the necessary repair parts for all corrective maintenance actions in addition to providing the maintenance service. Still a third alternative might be for the contractor to provide complete maintenance service for scheduled overhaul while the military provides complete maintenance service for all unscheduled repair.

There are two significant points which should be recognized when considering the nature of contractor vs. military support. The first is that there are numerous ways of describing support elements, and different systems may well require different groupings of support elements which should be considered for contractor support. The second point is that for any given group of support elements there is generally a variety of alternatives available where each alternative represents a different combination of support elements provided by the contractor; and that all such alternatives should be considered in order to arrive at an optimum contractor/military support mix.

In addition to the type of support elements provided by the contractor, there is a second dimension which should be considered in identifying various support alternatives. This second dimension is one of timing. In other words, contractor support of a specific nature may be provided for a given period of time after which the same support would be provided organically. Thus each time of transfer considered for any given type of support represents another support alternative.

To illustrate the above points, Table 1 indicates several support alternatives (combinations of support elements provided by contractor and military sources) which might be considered for a typical aircraft weapon system during the introductory phase.

Alternative No. 1 is for the contractor to provide for all corrective maintenance, all maintenance and operational training, and all spares and repair parts that might be required, while the military provides for the supply of all consumables. Alternative No. 2 is the same as No. 1 except that the military rather than the contractor provides for all operational training.

Alternative No. 3 has the military providing for all scheduled overhaul in addition to operational training and supply of consumables. This alternative assumes, however, that the contractor will still develop the scheduled overhaul procedures, design the special support equipment required, and develop the maintenance training plans and procedures. It should be noted in Alternative No. 3 under TRAINING that both the contractor and the military are involved in maintenance training -- the contractor for unscheduled repair and the military for scheduled overhaul.

Alternative No. 4 of Table 1 illustrates the case where contractor support is provided for a given period of time and then transferred to an organic facility. Each (X) bounded parenthetically indicates that the contractor will provide the corresponding element of support until a specified date of transfer to an organic facility. Various dates of transfer might be considered and in such cases each date

TABLE 1

ILLUSTRATION OF SELECTED SUPPORT ALTERNATIVES

SUPPORT ELEMENTS	Support Alternatives Indicating Providing Activity			
	Alt.1 C.*M.**	Alt.2 C. M.	Alt.3 C. M.	Alt.4 C. M.
<u>CORRECTIVE MAINTENANCE</u>				
<u>Scheduled Overhaul</u>				
● development and documentation of overhaul procedures	X	X	X	X
● actual overhaul operation	X	X	X	(X) (X)
● design of special support equipment	X	X	X	X
● procure and maintain special support equipment	X	X	X	X
● provide and maintain overhaul facilities	X	X	X	(X) (X)
<u>Unscheduled Repair</u>				
● development and documentation of repair procedures	X	X	X	X
● actual repair operation	X	X	X	(X) (X)
● design of special support equipment	X	X	X	X
● procure and maintain special support equipment	X	X	X	(X) (X)
● provide and maintain repair facilities	X	X	X	(X) (X)
<u>TRAINING</u>				
<u>Maintenance Training</u>				
● development of training plan and procedures	X	X	X	X
● conduct training	X	X	X	(X) (X)
● design of training aids and equipment	X	X	X	X
● procure training aids and equipment	X	X	X	X
● provide and maintain training facilities	X	X	X	(X) (X)
<u>Operational Training</u>				
● development of training plans and procedures	X	X	X	X
● conduct training	X	X	X	(X) (X)
● design of training aids and equipment	X	X	X	X
● procure training aids and equipment	X	X	X	X
● provide and maintain training facilities	X	X	X	(X) (X)
<u>SUPPLY</u>				
<u>Spares</u>				
● item management (including cataloging, inventory control, etc.)	X	X	X	(X) (X)
● procurement of required quantities	X	X	X	(X) (X)
● handling (including packaging, shipping, receiving, transportation, storage, etc.)	X	X	X	(X) (X)
<u>Repair Parts</u>				
● item management	X	X	X	(X) (X)
● procurement of required quantities	X	X	X	(X) (X)
<u>Consumables</u>				
● item management	X	X	X	(X) (X)
● procurement of required quantities	X	X	X	(X) (X)
● handling	X	X	X	(X) (X)

* Contractor

** Military

of transfer would represent another support alternative. The dates of transfer selected for consideration should represent significant points in the life cycle, particularly in the introductory phase. For example, alternative dates of transfer might include: delivery of first production aircraft; delivery of aircraft coinciding with first major configuration change; delivery of last production aircraft minus lead time to procure special support equipment; delivery of last production aircraft; or a year, or any other significant period of time, after delivery of last production aircraft.

It is recognized that, in considering support alternatives, all support elements are subservient to and exist only to enhance the operational capability of the weapon system. Therefore, any decision made with respect to what support elements might best be provided by the contractor will give consideration to the impact of the decision on the operation of the supported weapon system. Since each weapon system has unique characteristics and operational uses, the support alternatives considered will be identified on a case-by-case basis.

2. Advantages and Disadvantages of Contractor Support

There are a number of different types of potential advantages from the military point of view which could accrue through contractor support of a weapon system. Some of these are:

- 1) Quality of overhaul or repair
- 2) Simplicity of military support administration
- 3) Technological resources

- 4) Economic
- 5) Early support of a new system
- 6) Military personnel available for operational duty

The types of advantages listed above are not inherent in contractor support of any weapon system. They may or may not exist with respect to any given assembly within a given weapon system depending on the nature of the support considered. Thus, the advantages of contractor support must be evaluated on a case-by-case basis. In fact, some of the potential advantages listed above could be disadvantages in any given case. Generalizations at this time are hazardous and might encourage ineffective or costly support in some situations.

Similarly, there are several types of potential disadvantages which might accrue through contractor support; but again, these must be evaluated on a case-by-case basis. Some potential disadvantages are:

- 1) Loss of control over the maintenance or supply operations.
- 2) Inadequate transportation to and from contractor facility.
- 3) Price escalation of spares and repair parts.
- 4) Cost escalation of support services.
- 5) Inadequate technological resources for emergency use.

Most of the potential advantages and disadvantages of contractor support can be quantified and translated into economic terms to enable a comprehensive evaluation of

different support alternatives. For example, suppose that military decision makers are concerned about the loss of control over the repair operation of a particular aircraft assembly under a contractor support arrangement. In other words, there is a chance that the contractor may not be able to meet repair-turnaround time commitments due to strikes or other uncontrollable factors, and thus a shortage of the particular assemblies in question would result. If such a risk is considered to be of importance to the contractor vs. military support decision, then the cost of avoiding such a risk should be assessed and incorporated into the decision evaluation. This could be accomplished by assessing the probability of such an occurrence and calculating the cost of a sufficient number of insurance spares. The point is that support alternatives should be thoroughly and realistically evaluated before decisions are made.

In the early design stage the designer himself knows more than anyone else what support elements are needed. Since the designer is usually the contractor, it appears reasonable to rely heavily on him for support planning during that period. The design of the weapon system and the support elements and activities interact in such a way as to influence each other. The determination of the proper timing of the transfer of support activity from the contractor to the military department is an important decision. Another is the selection of what support activities and elements should be transferred. These kinds of support decisions involve support elements which evolve out of contractor-originated materiel and services. At the same time almost all weapon systems have need for support materiel and services which originate from sources already existing within the military departments.

The term "contractor support" is a broad one which refers to a number of different identifiable elements and activities, each of which needs to be considered and reconsidered at different times during the life of a weapon system.

3. Interservice Support

Interservicing is a support alternative which should be considered when an item of equipment is used by two or more departments. Interservice support is defined in DoD Directive 4000.19 as "action by one military service or element thereof to provide logistical and/or administrative support to another military service or element thereof. Such action can be recurring or non-recurring in character on an installation, area, or worldwide basis."¹ Interservice support can be provided on a reimbursable or non-reimbursable basis. Department of Defense policy prescribes maximum practical utilization of interservice support when economies can be realized without impairment of military effectiveness.

Interservice support could conceivably include any or all of the support elements that might be provided by a contractor. In choosing to use interservice support, the logistician should consider many factors similar to those he would consider in connection with contractor/military support decisions.

Interservicing decisions involve the evaluation of net benefits which will be accrued by establishing a single military support capability. When each military department provides support for a common or similar item of equipment, it is necessary to make duplicate investments in facilities and other resources such as tools, test equipments, and

¹Department of Defense Directive 4000.19, "Basic Policies and Principles for Interservice Support," 26 March 1960.

personnel training. Sometimes such investments have a potential use in other weapon systems or in follow-on systems; hence, the value of such investments is difficult to assess. It is difficult to forecast the contribution of duplicate assets in support of unforeseen emergencies or of follow-on weapon systems. The problem is complicated further by the fact that analyses and decisions would normally be made by personnel with strong biases. The bias would stem from judgments relating to the importance of service-assigned missions and the degree to which the proposed support capability would enhance successful accomplishment of such missions.

4. Levels of Support

The elements of support which might be considered for procurement from contractor sources or through inter-servicing arrangements are those types of activities that would normally take place outside the control of the operational user of the system being supported. More specifically, any element of support which must be under the control of the operational user is seldom a candidate for contractor support nor can such an element be reasonably considered for interservice support. The reason behind this statement is clear; that is, there are certain support elements that interact with the operation of a weapon system in the overall performance of its mission in such a way as to become an integral part of the operation. The simplest example of this is the handling, transportation, and storage within the operational environment of consumable items such as fuel and ammunition. In addition certain corrective maintenance actions are often required in conjunction with the performance of a mission, and such support as well as accompanying repair parts supply support must be under the

control of the operational command. Still another example of support which is often best to place under operational control is tactical training; this is particularly true where several units must function together in performance of a mission.

Levels of maintenance support are defined in DoD Directive 3232.1.¹ The lowest level, Organization Maintenance, is the responsibility of and is performed by the using organization. The two higher levels, Intermediate and Depot Maintenance, are not usually performed by the operational organization and frequently require higher skills, more elaborate tools, and equipment.

There is no "official" definition of depot level support. Depot level support is generally considered throughout the military establishment to include depot level maintenance as well as supply support normally obtained from a wholesale storage point or from a manufacturer. Support elements which emanate from or embrace a depot level maintenance operation are generally termed "depot level support" even though such elements may be provided by contractor sources.

While the above definitions of maintenance level activity are useful in planning an organic maintenance program, they seem inappropriate for the purpose of determining which materiel can best be maintained by contractor sources. A more useful classification of maintenance support for

¹Department of Defense Directive 3232.1, "Department of Defense Maintenance Engineering Program," November 3, 1955.

this purpose is provided in DoD Directive 4151.1¹ as follows:

"Direct Maintenance Support refers to that maintenance performed to materiel while it remains under the custody of the using military command. Upon restoration to serviceable condition, the materiel normally is returned directly to service."

"Indirect Maintenance Support refers to that maintenance performed to materiel after its withdrawal from the custody of the using military command. Upon restoration to serviceable condition, the materiel is returned to stock for reissue, or returned directly to the user under conditions authorized by the military department concerned."

For purposes of this study we have broadened the definitions of DoD Directive 4151.1 to include all the various elements and activities of support described earlier. Thus, "direct support" in this study refers to all support elements and activities which remain under the control of the command using the weapon system. "Indirect support" refers to support elements and activities provided from a source over which the user of the weapon system does not have direct control.

5. Related Decisions

The decision processes used by the military departments in identifying and utilizing contractor support are varied, complex, and often difficult to describe. In most cases the decision to use contractor support is based on or integrated with other related decisions. This LMI task is limited in scope in that it is directed at the introductory phase of a weapon system life cycle. However, the type and

¹Department of Defense Directive 4151.1, Subject: "Policies Governing the Use of Commercial and Military Resources for Maintenance of Military Materiel," July 28, 1960.

extent of support elements required are influenced by decisions which are made long before the first hardware is produced.

Most weapon systems begin their existence with "conceptual studies." These studies consider the threat which the weapon is to counter, the environment in which it will operate, various potential design parameters, logistic support concepts and many other factors. The possible combinations of tradeoffs among these factors require decisions with respect to the various sets of options which will affect logistic support. Thus the decision-making process is a continuing one commencing with concept formulations and proceeding through the preparation of requests for proposals from contractors, contract definition when utilized, source selection, design, development, test, introduction and operational use.

Control over such a complicated and complex aggregation of support decisions is maintained through logistic support policy and through the endorsement of support concepts. For example, operational requirements might suggest that support plans be prepared under a support concept of maximum base self-sufficiency. Another requirement might dictate a support concept of minimum amount of maintenance under the control of the operational user. These two concepts illustrate opposite extremes and will result in completely different decisions with respect to what support elements and activities are needed. Support equipment, spare parts, personnel skills, training programs and maintenance procedures would be quite different for the same weapon systems supported under each of the two concepts. The importance of having clearly enunciated guidance can best be illustrated by considering what would happen to the operational effectiveness of a weapon system which was conceived, developed and

procured under a concept of maximum base self-sufficiency but was deployed into an environment where a support concept of minimum maintenance forward was in effect.

Although concepts such as maximum base self-sufficiency and minimum maintenance forward are quite dissimilar, either might be adopted by a military department for a particular weapon system. There are two major factors that should govern such a decision. They are operational readiness requirements and economic requirements. The first is always paramount, but once having satisfied the operational readiness requirements the cost of providing support should be considered. The use of contractor support if properly evaluated and structured could serve to enhance the success with which both requirements are met.

Another type of decision which affects support concerns repair versus discard and various related options. Repair-discard decisions intrinsically consider contractor vs. organic support. If an item of equipment becomes inoperative, the first decision is between the alternatives of repair or not repair. If the choice is not to repair and if the item is still needed, a decision to use a certain type of contractor support has in effect been made. In other words, a contractor will no doubt be used as the source of replacement items; that is, items which are only obtained from a manufacturer. On the other hand, if the decision is to repair, other support options become available and choices must be made among them. One such set of alternatives is between repairing in place and repairing elsewhere. Another is between removing, repairing, and replacing the same item as contrasted with removing, repairing by replacing with a new item, and repairing the inoperative item at another time or in another location. If the latter alternative is selected, then still more options become available including repair in

organic facilities or in contractor facilities. Such choice can generally be made on an economic basis provided the operational readiness posture of the weapon system is not degraded by any of the options.

In this study an attempt is made to determine the extent to which pertinent related decisions and various military constraints could be controlled and should be interwoven into an overall decision process dealing with contractor support.¹

B. DESCRIPTION AND ANALYSIS OF CURRENT PRACTICES
FOR UTILIZING CONTRACTOR SUPPORT

1. Practices for Utilizing Contractor Support

Each military department has issued implementing instructions and regulations which are based on the policies and procedural guidance contained in the OSD Directives and Instructions. A number of these² which are pertinent to contractor support have been examined, and selected ones will be discussed later in the report. In addition each department has published manuals or guides which contain instructions related to the preparation of support plans and the management of support activities. The instructions, while voluminous, are still quite general, and since each logistic support activity and element is treated as a separate case and is considered many times during the life of the weapon system, it is difficult to identify a single complete set of standard procedures specifically related to the use of contractor support.

¹Criteria for Repair vs. Discard Decisions

²See Exhibit II for partial list.

Among the departments there are some general similarities but few significant differences. One of the most striking similarities is that each aims at having, as far as possible, a complete organic support capability in being when a new weapon system is first placed in the hands of the operational units. An operational unit is not necessarily one which is ready for combat or even one which will ever go into combat. It is usually a special test organization set up to affirm and assure that the system can be operated and supported under operational or combat conditions. The support activities and elements therefore are made to resemble as closely as possible the organic support that is planned for eventual use.

In each department, an organic support target date is generally selected to coincide with the delivery of production items to the operational user. Establishing a target date is a practical matter of necessity in order to tie all of the various support plans together. Providing support materiel and services is a complicated process involving long lead times extending as much as five years into the future. The establishment of a target date fixes a scheduling and planning milestone toward which many functionally different activities can work in an orderly manner. This date then becomes a target toward which all who are responsible for the various elements of support can shoot. In actual practice, a truly complete in-house support capability can seldom be achieved on the target date.

All three departments exercise flexibility in the extent to which the contractor is utilized to provide support. During the development and early production phase several different techniques may be used to fit the requirements of the particular item of equipment. The techniques

may vary from requiring responsibility from the contractor for full support over a specified period of time to responsibility for limited support consisting only of certain specified goods and services for a limited period of time. Phased provisioning and deferred procurement of selected items of spares and equipment are also techniques that are applied on a tailored and flexible basis. Contractor support which is utilized in this manner is sometimes called "augmented" or "interim" support. It may also include contractor provided technical engineering services used to assist in maintenance of equipment and in providing on-the-job training.

In a new weapon system acquisition program, a number of the first aircraft that are produced are utilized for tests. During this early design, development, and testing stage all three military departments rely heavily on the contractor for support, and there are at least three important reasons for this. The first stems from the fact that when the contractor designs the system hardware, he is the most obvious and logical choice to design the system's peculiar support procedures. In addition to possessing necessary information pertaining to the hardware design and to the operational use, the contractor usually has a contractual responsibility to devise appropriate support procedures and to demonstrate them along with the maintainability and supportability of the weapon system. The second reason is related to the fact that more design changes are made during the development and testing phase than during later phases. Since the hardware design changes invariably affect the support requirements and procedures, the impact of the changes on support elements can be limited to the contractor's activities. In other words, the impact on established organic support activities is lessened or eliminated

entirely by requiring the contractor to provide the support. A third reason is that the contractor can provide more timely response to changed support needs brought about by design changes. Hardware designers and support system designers working within a single organization are able to coordinate their actions better than they could if they had to go through a third party in the military departments. Such close coordination can result in quicker action.

At the same time each department makes full use of the flexibility granted by OSD policy and procedural guidance and even during this period when contractor-furnished support is the general rule, some organic support is usually provided. In general, the support needed in connection with the government-furnished equipment (GFE) used on the contract end item (CEI) is provided from organic sources whenever it is available. Support for common or standard Aerospace Ground Equipment (AGE) is usually provided from organic sources during this stage also.

Two considerations are raised by these procedures. One, the contractor must develop the capability to provide many of the support activities and elements needed to demonstrate the supportability of the weapon system which he has designed. This represents an investment in support capability which should be utilized as effectively as possible. The extent to which the capability can be used should be examined in connection with a disciplined analytical procedure. The examination should include direct vs. indirect support, the total contractor capability, peak capacity required, alternative ways of providing the support, and associated costs. The second consideration is that decisions to provide support from government sources should also be backed up by similar analytical procedures.

An important similarity common to all three departments is that none use a uniform disciplined procedure to make comparative cost-effectiveness analyses between the alternatives of contractor or organically provided support. Neither are there uniform disciplined procedures in use to make cost effectiveness analyses between interservicing options. Economic analyses are often made but the criteria, cost factors, and methods of calculation are not uniform, and hence, the analyses are non-comparable. It is difficult to determine whether any one department or any single weapon system has a better method than the others for optimizing contractor vs. organic support decisions.

There are differences among the services in philosophy regarding the use of contractor support. To some extent, these differences stem from different operational doctrine. The Army recognizes three categories of maintenance below the depot level. The Air Force and the Navy recognize two categories:

<u>Army</u>	<u>Navy</u>	<u>Air Force</u>
Depot	Depot	Depot
General Support	Intermediate	Field
Direct Support		
Organizational	Organizational	Organizational

Army doctrine requires planning for overseas immobile depots when needed in support of deployed Army forces. In addition the Army contemplates the use of combat service support units for intermediate support ("direct" and "general" support in Army terminology). All Air Force depots are located in the CONUS, are fixed and immobile. The Navy

obtains most of its depot level support from depots in the CONUS; however, it does obtain some support from Mobile Logistic Support Forces (tenders) and from overseas bases.

When support is required in the combat area, extensive organic capability may be justified. The nature of the support, however, can have a significant impact on mission-effectiveness. For example, a remove and replace policy in lieu of a remove, repair or overhaul, and replace policy might result not only in a higher operational readiness posture but also in performing the overhaul operation in an area less vulnerable to enemy attack. In such a case the use of contractor support in performing the overhaul operation might further contribute to improved mission-effectiveness as well as improved economy.

Overall organic support capability at the depot maintenance level varies among the three services. Many factors affect both the existing and the potential capability. Invariably, there are support elements and activities in being which can be used to provide needed support to a new system without any alterations. Certain other support elements can be provided by slight alterations to existing facilities and equipment and by upgrading personnel skills. Still others will be completely novel or unique and thus will have to be developed. Much depot level support equipment and tooling is expensive, but once secured provides a capability that can support more than a single unique piece of hardware. Engine test stands, and rotor blade whirl towers are typical examples of such equipment. Decisions concerning the acquisition and installation of these kinds of resources have a bearing on options of contractor support, organic support, or interservice support. The current level of depot support capability often motivates decisions regarding the use of the contractor.

In some weapon system acquisitions, prototypes are procured and tested before the production contract is awarded. The OH-6A and the AH-56A are examples of this procedure.

The OH-6A was produced in quantity after an extensive series of tests of prototype aircraft, five each of which were procured from three different manufacturers. Each contractor furnished a major portion of the support needed for his particular aircraft during the tests. Complete support was not furnished because a portion of the tests was devoted to demonstrating supportability by the Army. Under those test circumstances much of the support was provided by the Army with each different contractor furnishing augmented assistance as necessary.

Ten prototype AH-56A aircraft are being procured. While the prototypes are being produced, tested, and demonstrated, almost complete support will be provided by the contractor. The support is identified and specified in the contract¹ and covers supply, maintenance, technical and training support.

The OH-6A and the AH-56A are representative of two different kinds of prototype programs. The OH-6A was the result of a design competition involving prototypes. Since supportability of the systems was an important factor considered, each contractor was required to demonstrate supportability utilizing contractor support resources.

¹Appendix B, Contract No. DA23-204-AMC-03667(T), Advanced Aerial Fire Support System Test Support Requirements, 12 February 1966.

The AH-56A prototype program was aimed at proving a design, and at the same time developing the necessary support procedures and requirements. In both programs small numbers of aircraft were involved, design configuration was subject to high probability of change, and production quantities were uncertain.

Each service has developed comprehensive planning and management systems needed to acquire complete weapon systems and provide for their support. Each management system includes provisions for utilizing the contractor to provide various selected elements of support. The detail of the differences would be too voluminous to analyze or to include in this report, as reference to the documents listed in Exhibit II will confirm. However, a brief discussion of some of the general procedures may be useful.

The Navy management system which covers procedures for making use of contractor provided support to aircraft systems is described in "Weapons Requirements," WR-30, 1 May 1963. The procedures are currently under revision under the title, "Naval Air Requirements," AR-30. The Army management system and Army procedures are covered in "U. S. Army Aviation Materiel Command Integrated Logistic Support, With Contractual Requirements for MEADS, Maintenance Engineering Analysis Data System," PP-AVCOM-ILS/MEADS-3R, July 1966 (Interim Procedures). The guidance in these two documents is similar¹ in that both provide a procedure for developing the detailed specifications of the support elements to be furnished by a contractor

¹Assistance was provided to the Army in writing and developing ILS/MEADS by the same individual who was a major contributor in writing and developing WR-30.

in connection with the design, development, test, and early introduction of a new aircraft weapon system. The publications themselves can, by reference, be used as contractual documents. In practice neither WR-30 nor ILS/MEADS provide a complete standard procedure for utilizing contractor support. Both include references to numerous other documents such as service manuals, instructions, regulations, handbooks, military standards and military specifications. Both require the contractor to prepare a recommended support plan which will always cover the support needed during the development and test phases, and plans for making the transition from contractor to organic support. Invariably this proposed support plan will cover support elements to be provided from organic sources as well as elements to be provided by the contractor. Both provide for the establishment of a joint contractor/government Integrated Logistic Support Management Team whose function is to review, coordinate and, where appropriate, to approve the contractor submitted support plans. Both provide for obtaining support elements from the contractor on a case-by-case basis which are subject to approval by the Government. The extent and amount of support can vary among weapon systems and the extent of variance is dependent on the amount of in-house capability that is achieved or planned. There seems to be a prevalent impression that WR-30 and ILS/MEADS are only used to obtain contractor support. In reality the two documents do much more than this. As support management systems, they provide for integrated logistic support planning by the contractor and all interested service activities as well as a method of documenting support requirements and procedures.

The procedures which are prescribed in WR-30 and in ILS/MEADS are similar in general, but for practical reasons they differ in detail. The main reason is that each procedure has been devised to be responsive to the management

concepts and the logistic systems which are used by its particular service.

The Air Force procedures for planning the acquisition and support of a new weapon system are contained in the 375 Series of Air Force Regulations and in the 375 Series of Air Force System Command Manuals. Weapon system acquisition in the Air Force is generally accomplished under a "System Program." The acquisition of a system, beginning with the conceptual studies and proceeding through the design, development, test, and production stages, is the responsibility of Air Force Systems Command (AFSC). Early in the life of a system, logistic support responsibility rests largely with the AFSC and later on, after the end of production, is transferred to the Air Force Logistics Command (AFLC).

When a weapon is to be obtained under the "System Program Concept" a System Program Director (SPD) is appointed. The SPD establishes a field organization comprised of membership authorized to represent the AFLC, the Air Force Training Command (AFTC) and the using commands. One of the early tasks of the SPD is the preparation of a System Package Program which contains sixteen sections.

One, the Logistics Section (Section 8), is originated by AFLC, but inputs are also obtained from other participating activities, including contractors, the using commands, and the training command. The Logistics section covers the logistics planning and programming for maintenance, supply, engineering, quality control, configuration management, transportation, packaging, packing, preservation, materiel handling, data processing, appropriate test support, depot and base level support (contractor and organic), and other aspects of logistics support. The support needed during the

whole life cycle of the system is considered, including the overlap of the operational phase back into the acquisition and testing phases. The remaining sections of the System Package Program are devoted to program management operations, civil engineering, personnel training, financial and other matters related to the acquisition and introduction of the weapon system.

Air Force procedures for acquiring the needed support address the same support problems that are faced by the Army and the Navy. Each support activity and element is considered on a case-by-case basis within the general policy of obtaining a complete organic capability eventually. The different detailed procedures for planning and acquiring the support activities and elements exist mainly because of the differences in organization and in management philosophy. The procedures are flexible as is demonstrated by the fact that for both the F-111 and the A-7, the Air Force is using a portion of the Navy WR-30 procedures, namely MEAR (Maintenance Engineering Analysis Recording System). Air Force Systems Command Manual 375-1 is also a specification type document which can be included in a contract by reference.

For the purpose of making some broad and general comparisons of the Army, Navy, and Air Force procedures for acquiring needed support, the Army and Navy procedures will be considered together and referred to as the WR-30/ILS system.

One point for comparison lies in the timing of the application of the procedures. The Air Force system begins to apply the procedures for identifying needed support elements and activities beginning in the conceptual phase. The data which commence to be generated at that time are used in a continuing series of studies and considerations lasting well into production and deployment of the weapon

system. The WR-30/ILS system begins to be applied at a point in time during the weapon system life cycle after a contract has been executed. In the WR-30/ILS system the first specific support planning document pertaining to a given weapon system is prepared by the contractor. In the Air Force system it is first proposed by the service. The WR-30/ILS system is designed to be an Integrated Logistic Support (ILS) management system. The Air Force system covers a larger area including the total management of the acquisition of the weapon system. Logistic support is included within that overall management system along with other related but distinct functional activities such as design, system engineering, civil engineering, procurement, production, funding and operation of the system.

All three systems refer to cost effectiveness analyses as being a necessary consideration in decisions regarding logistic support elements. However, none of the systems prescribe the detailed procedures for making the analyses, and no such analyses were found where the effectiveness of various different support options were compared. During the study very few examples of economic analyses were found. The concept of attaining organic support self-sufficiency apparently is used to negate their necessity. This is considered to be a serious omission.

It would serve no purpose to describe in detail all of the procedures used by each military department in reaching decisions either to utilize or not to utilize contractor support. The decision process in each military department is diffusive and no two systems, even in the same department, are necessarily subjected to identical procedures. There are, however, some questionable practices common to all three services. These are:

(a) The general tendency is to achieve maximum organic support at the earliest practical date.

(b) Little effort is made to identify, evaluate, and document non-economic criteria or constraints which influence the contractor vs. organic support decisions.

(c) Each department relies strongly on the contractor to develop support plans and requires the contractor to make cost-effectiveness tradeoffs. However, not much guidance is given him regarding support options and decision criteria to be used in making cost-effectiveness tradeoffs.

(d) Procedures do not encourage maximum utilization for support purposes of the investment in equipment, facilities, and organization which is made for development, test, and production.

2. Developments and Trends Affecting Contractor Support

Support costs have kept pace with the rising costs of developing and procuring hardware associated with modern weapon systems. Efforts aimed at controlling such costs have interfaces with various support concepts and elements. For example, the Department of Defense Programming System, the System/Project concept of managing weapon system acquisitions, the Engineering Development of major projects through use of Concept Formulation and Contract Definition, the Configuration Management System, the Total Package Procurement concept, and Life Cycle Costing all represent techniques which can contribute to or have an effect on the contractor-organic support decision process. One of the major purposes inherent in each of these concepts is to identify and manage the total costs of ownership of a weapon system. Consequently, there is much more attention being paid today to collection of data pertaining to those costs. Contractors have not been able to devise ways and means to use the cost data effectively in tradeoff and cost-effectiveness analyses. Unfortunately, the differing analytical methodology make meaningful comparisons difficult when it is necessary to choose from among options

such as those offered by contractors in responding to Requests for Proposals. An indication of the amount of effort being generated in connection with the Total Package Procurement concept can be obtained by the claim of one C-5A airframe competitor. He estimated that ten times as much was spent on the C-5A contract definition as on a similar aircraft program (not TPP) under contract definition. The major portion of the added costs were attributed to defining logistic support in sufficient detail to price. Another contractor estimated that the financial data requested was 32 times the amount requested on another recent aircraft program.¹

The responses to the C-5A RFP collectively weighed 35 tons, and one firm presented 625 volumes of documentary material. One contractor claimed 50% of the total effort was expended on the definition and pricing of support elements and implied that it was not used. Although the C-5A is a large aircraft, it is no more complicated than the F-111 or the AH-56A. The point is that although logistic support is an extremely complex subject, newer weapon system programs provide all the data necessary to make meaningful evaluations with regard to contractor vs. organic support decisions.

3. Policy and Procedural Guidance on Contractor Support

Policy and procedural guidance pertaining to the use of contractor support emanates from the Office of the Secretary of Defense in several different documents rather than a single document. The Deputy Assistant Secretaries

¹Total Package Procurement Concept, Synthesis of Findings, LMI Task 67-3, June 1967, pp. 20 and 28.

under the Assistant Secretary of Defense (Installations and Logistics) have responsibilities for various aspects of contractor support. Other Assistant Secretaries of Defense as well as the Director of Defense Research and Engineering also have an interest in certain aspects of contractor support. Thus policy guidance bearing on contractor support appears under a variety of subject headings in the form of DoD Directives, Instructions and Handbooks. Some of these documents are listed in Exhibit II. Due to the diversity of interest in utilizing contractor support, it is important to recognize certain broad governmental policies concerning logistics support and how such policies affect contractor vs. organic support decisions made by the military departments. These policies are not always enunciated specifically but are often implicit only; however, they can be described in general terms.

Traditionally each military department has provided logistic support to its assigned forces. This is one important basis for the tendency for each department to achieve as early as possible organic self-sufficiency for the support of each newly acquired weapon system. On the other hand, another general policy explicitly delineated in Bureau of the Budget Circular A-76, Revised,¹ prescribes that the Government will, wherever practical, rely on the private enterprise system to supply its needs. Various qualifications and exceptions are included in these policies which serve to resolve the apparent contradiction.

BoB Circular A-76 is the basis for several implementing documents issued by the ASD(I&L) and the military departments. The Circular defines commercial or industrial activi-

¹Bureau of the Budget Circular A-76, Revised, August 30, 1967. Subject: "Policies for Acquiring Commercial or Industrial Products and Services for Government Use."

ties in such a way as to include a great many support activities normally provided by the military departments from in-house resources. It describes the circumstances under which it is in the national interest and hence is permissible to furnish material and services from organic instead of commercial sources. Such circumstances exist when:

- "a. Procurement of a product or service from a commercial source would disrupt or materially delay an agency's program. . . .
- "b. It is necessary for the Government to conduct a commercial or industrial activity for purposes of combat support or for individual and unit retraining of military personnel or to maintain or strengthen mobilization readiness.
- "c. A satisfactory commercial source is not available and cannot be developed in time to provide a product or service when it is needed. . . .
- "d. The product or service is available from another Federal agency. . . .
- "e. Procurement of the product or service from a commercial source will result in higher cost to the Government. A Government commercial activity may be authorized if a comparative cost analysis prepared as provided in this Circular indicates that the Government can provide or is providing a product or service at a cost lower than if the product or service were obtained from commercial sources."¹

The Circular also contains guidance concerning the establishment of completely new activities and the modification of existing ones. It contains provisions for reviewing the need to continue existing government-operated commercial or industrial activities. It prescribes procedures for calculating costs and for making comparative cost analyses.

Two provisions of BoB Circular A-76 have an important bearing on contractor-organic support practices. The first is the recognition that support of combat operations may

¹Ibid, p. 3.

necessitate military operation of an industrial-type activity. The determination of that necessity is left up to the military departments. The second provision is that where there are no overriding considerations the choice between obtaining products or services from government or commercial sources should be based on a comparative cost analysis of the alternatives.

Implementing instructions to BoB Circular A-76 have been prepared and issued by ASD(I&L) and by each of the military departments.¹ In each case the basic policy and intent outlined in BoB Circular A-76 is repeated. DoD Instruction 4100.33 elaborates and expands on the circumstances or criteria contained in the Circular and quoted on page 42 of this report.

Three points in DoD Instruction 4100.33 relate to the contractor-organic decision. First and most important is the explanation and further development of the criteria pertaining to the support of combat operations, retraining of military personnel and mobilization readiness (see criteria

¹These are:

Department of Defense Directive 4100.15, "Commercial or Industrial Activities," July 9, 1966.

Department of Defense Instruction 4100.33, "Commercial or Industrial Activities--Operation of," July 22, 1966.

Army Regulation No. 235-5, "Industrialized Facilities and Activities, Commercial and Industrial-Type Activities," 28 November 1966.

SECNAVINST 4860.44, MAT 0442, "Commercial or Industrial Activity--Operation of," 14 July 1967, and Change 1, 4 October 1967.

Air Force Regulation 26-12, "Use of Contract Services and Operation of Commercial or Industrial Activities." 9 February 1967.

on page 42). The necessity to conduct a military in-house commercial or industrial activity is recognized when it is based on the need to ". . . achieve self-sufficient military capability for the operation and direct maintenance support of their mission-essential equipment, and the requirement for DoD components to retain an in-being depot level maintenance capability as outlined in reference (C)."¹ Secondly, the Instruction establishes a policy which requires that an economic or comparative cost analysis be used as the basis for selecting the alternative of securing products or services from either military or contractor sources. Exceptions are recognized and allowed when programs would be disrupted or delayed, when commercial sources are not feasible, when the support is available from another federal agency, and when there is a military necessity for the in-house capability. Third, the Instruction requires investigation into the possible use of interservicing as a means of providing the needed support.

The implementing documents issued by each of the military departments carefully repeat the foregoing policy and procedural guidance. Each military department implementing instruction addresses the military necessity criterion and provides definitions and explanations of the terms which are used. For example, the Army in AR 235-5 states:

"This criterion includes the need for troop units to conduct training and retraining in order to achieve

¹The quotation is from Department of Defense Instruction 4100.33, "Commercial or Industrial Activities--Operation of," July 22, 1966, p. 5. Reference (C) is Department of Defense Directive 4151.1, "Policies Governing the Use of Commercial and Military Resources for Maintenance of Military Material," 28 July 1960. Policies contained therein are discussed in this report beginning on p. 45.

self-sufficient military capability for the operation and direct maintenance support of their mission-essential equipment, and the requirement for the Army to retain an in-being depot level maintenance capability."

The Navy in SECNAVINST 4860.44 states:

"This criterion includes the need for military units to conduct training and retraining in order to achieve self-sufficient military capability for the operation and direct maintenance support of their mission-essential equipment, and the requirement for the Department of the Navy to retain an in-being depot level maintenance capability. . . ."

The Air Force in AFR 26-12 refers to the criterion as follows:

"Normally, military personnel will only be used in those positions which are military-essential. . . .

"Training or retraining of military personnel or units including training or retraining to achieve self-sufficient military capability for the operation and direct maintenance support of their mission-essential equipment. . . .

"Maintenance of an in-service depot level maintenance capability. . . ."

Each department classifies and defines direct combat support functions as being a military necessity, thus exempting them from the general policy of providing support from commercial sources. Each military department makes special reference to "direct maintenance support of mission-essential equipment."

Policy and procedural guidance which the Office of the Secretary of Defense has issued relating to the selection process for maintenance support is contained in DoD Directive 3232.1 and DoD Directive 4151.1.¹

¹Department of Defense Directive 3232.1, "Department of Defense Maintenance Engineering Program," November 3, 1955, and Department of Defense Directive 4151.1, "Policies Governing the Use of Commercial and Military Resources for Maintenance of Military Materiel," July 28, 1960.

DoD Directive 4151.1 is in the process of being revised and an early draft of the revision has been examined. The draft does not change basic policy with respect to contract or interservice support, but it does contain a slightly different definition of "mission-essential materiel." It is the mission-essentiality of materiel that is used under current policy to justify organic support. Both definitions are quoted below:

Current 4151.1 - "Mission-Essential Materiel: Consists of those weapons, equipments, and systems (including spare components and support equipments) which have been determined to be vital to a primary defense mission; the unserviceability or failure of such materiel to meet design performance would jeopardize a basic defense assignment or objective."

Draft 4151.1 - "Mission-Essential Materiel: That materiel, authorized and assigned to approved combat and combat support forces which would be immediately employed to (1) destroy the enemy or his capacity to continue war, (2) provide battlefield protection of personnel, (3) communicate under war conditions, (4) detect, locate or maintain surveillance over the enemy, and (5) permit contiguous combat transportation and support of men and materiel."

The policy promulgated in both the current and draft versions of DoD Directive 4151.1 implies a mix of contractor and organic support which will provide a source of maintenance support under military control in emergency or wartime conditions. It defines mission-essential materiel and then assigns to the military departments responsibility for developing a minimum organic capability to support this mission-essential materiel. Any support requirement above the minimum may be furnished by contractor or interservicing sources.

Equipment can be assigned degrees of mission-essentiality for the purpose of determining priorities and allocating resources. However, the mission-essentiality of equipment

concept cannot provide the only criteria needed for identifying and selecting support options. First, there are few items of materiel that would not be considered mission-essential under the above definition. Certainly, materiel pertaining to fixed and rotary-wing aircraft systems which are being introduced into the military services would be considered mission-essential. Any weapon system or its equipment not considered mission-essential would be subject to cancellation. Therefore, it is probable that this interpretation of OSD maintenance policy under the current definition of mission-essential equipment actually tends to prevent the consideration of contractor support for any new weapon system regardless of the potential advantages of the options.

This interpretation of policy relates organic support requirements to the mission-essentiality of equipment and tends to ignore the determination of the essentiality of a support activity at the direct or indirect level.¹ In considering alternative support sources, the logistician should consider the proper assignment of control over various support elements. The question then is whether the support elements need to be accomplished under the control of the military commander who also has responsibility to accomplish the military mission while using the weapon system.

Our study of the Army, Navy, and Air Force practices for utilizing contractor support confirms the emphasis on the mission-essentiality of equipment concept in the decision-making process. Unless the support element is one which the contractor alone has the capability to provide, the general goal in all services is to attain complete in-house support

¹See definitions on page 24 of this report.

self-sufficiency as early as possible. The question of organic vs. contractor support is often not even considered. Careful and critical analysis of the need to place various support elements under the control of the operational user of the weapon system is required. The aim should be to enhance the mission-effectiveness of the weapon system and not unduly burden the operator with support activities.

If a direct support activity can not be justified as necessary to enhance mission-effectiveness or operational readiness, then the activity should be subjected to an economic analysis and compared with various indirect support options. Justification for a direct support activity might include satisfying mobility, security, or reliability requirements. Once it has been determined that direct support is not essential, then all support options -- direct and indirect -- should be considered from a support effectiveness and from an economic point of view. If the final decision must be made on the basis of overriding non-economic constraints, at least the economics of the situation will be known.

Numerous other policy and procedural guidance documents relating to the contractor - organic support question were reviewed and some of these are listed in Exhibit II. One important series is that concerning provisioning, especially phased provisioning since that is a procedure for utilizing certain contractor resources for support. The entire provisioning activity is aimed at identifying and providing the spare parts, tools and equipment needed to support and maintain the weapon system in its operational environment. Provisioning decisions must often be made in an atmosphere of uncertainty and risk. While some support requirements can always be forecast quite accurately, others can not. The inability to forecast all requirements accurately forces logisticians to strike a balance between the risk of

breakdown for lack of spares on the one hand, and the procurement of excess spares on the other hand. It seems obvious that provisioning decisions can be sharpened and risks can be identified better if all feasible support options are analyzed in a disciplined manner.

In the next section of this report a conceptual decision network is offered as a disciplined way to conduct the management of this complex activity.

C. PROPOSED DECISION GUIDELINES

Current practices used by the military departments in determining the type and amount of industry services to utilize in support of fixed and rotary wing aircraft were found to contain many weaknesses. No existing set of procedures could be clearly identified which would in our view represent a "best" method, or even an acceptable method, of making contractor vs. organic support decisions. Principal among the many weaknesses identified was the absence of well-disciplined support effectiveness and economic analyses. Although it is conceivable that some general rule of thumb with respect to the type, amount and timing of contractor support to be utilized might at some point be developed, it was concluded that without benefit of many cases subjected to support effectiveness and economic analyses any such rule of thumb would not be broadly applicable. Therefore, a proposed technique for evaluating the use of contractor support on a case-by-case basis was developed and is presented in this section of the report. It is believed that the proposed technique may have broader application than simply evaluating contractor support in that a variety of other support options might also be considered concurrently.

This task order did not require the application of the proposed technique to actual cases of fixed and rotary wing aircraft and that was not done; however, discussions with various personnel indicated no apparent problems in applying the technique. In fact the opinion was expressed by several that application of the technique would result in a less costly exercise for developing a proposed equipment support plan than is now the case.

The proposed guidelines are presented in three major parts. First is a description of the technique, its purpose, application and general decision network. The second part presents the analytical models and illustrates their use. Finally, some potential auxiliary benefits of the proposed technique are presented and discussed.

1. Description of Proposed Technique

- a. Title: Support Planning Optimization Technique.

- b. Purpose: To provide a standard methodology for identifying and evaluating feasible support options associated with a weapon system in order to achieve an optimum balance among support effectiveness, operational readiness, and support costs.

- c. Principle Products: Application of the proposed technique will result in two principal products. First is an identification of specific assemblies, equipments or components which are recommended for corrective maintenance, repair or overhaul by various specified sources. Second is an identification of specific support elements or activities which are recommended to be provided by various specified sources. The various support sources considered will include direct military (organizational), indirect military (intermediate and depot), interservicing (depot by one department on behalf

of other using departments), and contractor. Contractor sources may, where appropriate, include several different contractors such as the system design contractor, design subcontractors, production contractors, equipment vendors, or maintenance service contractors.

d. Areas of Application: It is intended that the proposed technique be applied in two principal areas. The first area of application is during the initial support planning process. The technique could be applied by contractor personnel as a basis for recommending a specific support plan and an associated list of spares and repair parts for initial provisioning. In this case the cognizant military department would indicate the various support options to be considered and furnish the contractor with quantitative values of pertinent decision criteria for the military support options.¹ Another way to apply the technique would be to request pertinent data from the contractor and have the cognizant military department make the required analyses.

The second area of application is after the introductory phase of a weapon system when it appears advisable to revise the initial support plan. This could occur at any time during a weapon system life cycle when operational readiness, support effectiveness, or support costs need to be examined for corrective action. In such cases the cognizant military department would identify support options to be considered. The technique could then be applied either by the military, by prospective contractors, or jointly to determine the most effective support option to adopt.

¹A sample of quantitative values for decision criteria is contained in AMC Regulation 750-33, "Economic Evaluation of Maintenance Support Alternatives," 9 June 1967.

e. General Decision Network: The proposed technique consists of six principal analyses integrated into a general decision network as illustrated in Figure 1. Each principal analysis is identified in Figure 1 by an encircled number for ease of reference in our discussion. The six principal analyses are:

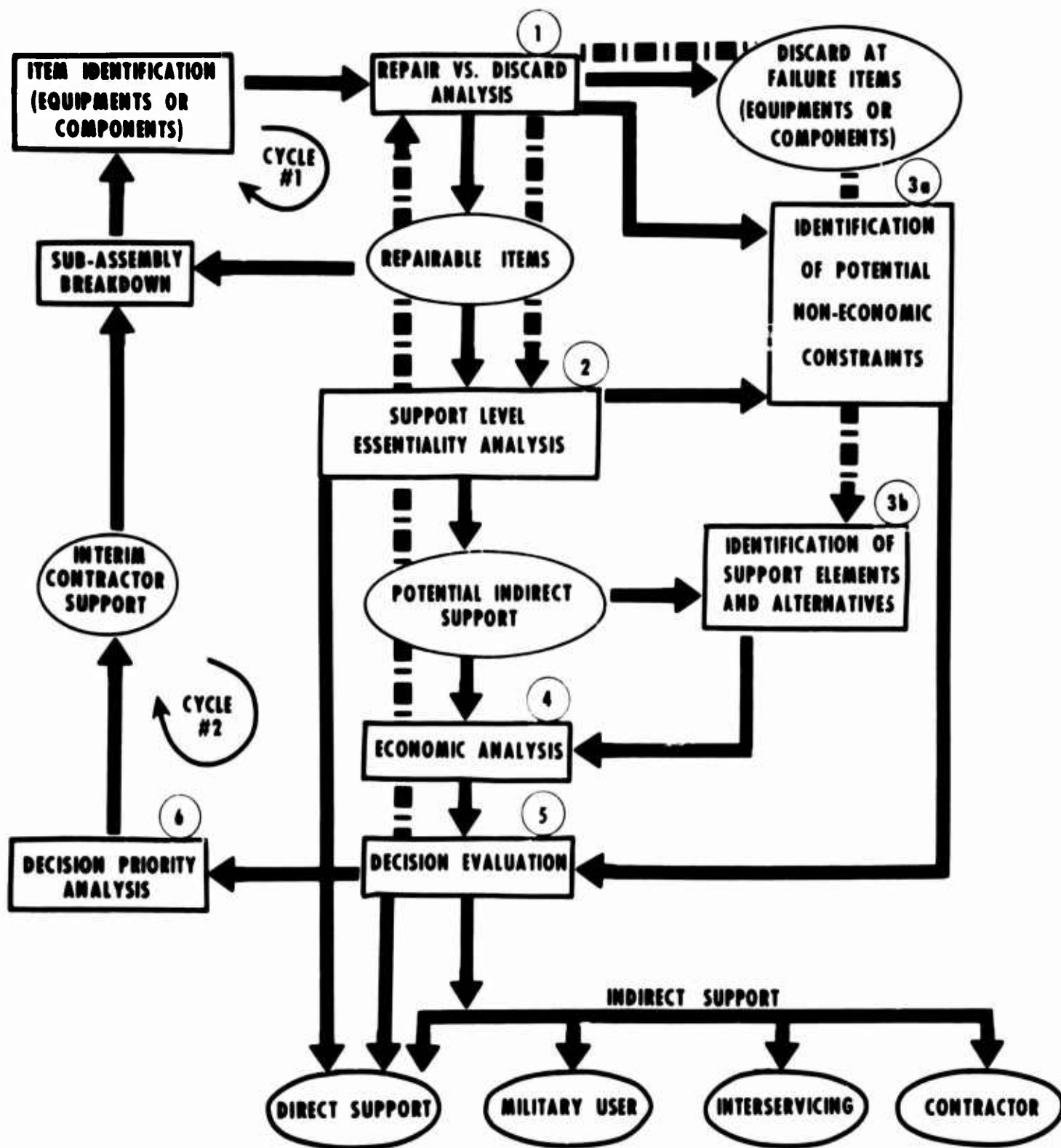
- ① Repair vs. Discard Analysis
- ② Support Level Essentiality Analysis
- ③a Identification of Potential Non-Economic Constraints
- ③b Identification of Support Elements and Options
- ④ Economic Analysis
- ⑤ Decision Evaluation
- ⑥ Decision Priority Analysis

The decision process begins with the identification of the highest level of assembly (end article, equipment, or component) which is to be considered as depicted in Figure 1 by the box in the upper left hand corner. The end article or assembly is then subjected to a repair vs. discard analysis (box ①) which results in a decision to either discard at failure or repair the item. If the item is determined to be a repairable, then the major subassemblies of the item are identified and each is subjected to a repair vs. discard analysis. This process continues until all assemblies or parts comprising the end article have been identified as either discard at failure or repairable items (cycle 1).

The repair vs. discard analysis is basically an economic analysis, but should also consider non-economic technological and military constraints. Where such constraints are identified as a result of the repair vs. discard analysis, they should be documented and held for consideration during the final decision evaluation analysis (box ⑤).

FIGURE 1

SUPPORT PLANNING OPTIMIZATION TECHNIQUE **DECISION NETWORK**



It should be noted at this point that in May 1966 LMI completed a study of the repair vs. discard decision process.¹ That study concluded in part: ". . . to achieve a more optimum balance of economic support without sacrificing military effectiveness or operational readiness, appropriate repair/discard decisions must be integrated with certain other related decisions. . . ." The study went on to identify some of the related decisions which included ". . . contractor vs. military maintenance; level of maintenance; and centralized vs. de-centralized maintenance. . . ." The Support Planning Optimization Technique proposed here is a method of integrating such support decisions. Therefore, in some cases the repair vs. discard decision may be deferred until various support options under a repairable concept have been analyzed. In such cases the decision process would follow the broken arrow in and out of the repair vs. discard analysis (box ①) as shown in Figure 1.

The second analysis is the support level essentiality analysis (box ②). This analysis is directed toward each repairable assembly (or potentially repairable assembly) and is concerned with the essentiality of "direct support"² for other than economic reasons. In other words, the analysis addresses the question: Is it essential for reasons affecting mission effectiveness or operational readiness that any given repairable assembly be repaired under the direct control of the using command when that assembly has failed or is malfunctioning? If the analysis results in an affirmative

¹Criteria for Repair vs. Discard Decisions, LMI Task 65-15, May 1966.

²For a definition of "direct support," see page 24. For the rationale leading to this definition, see discussion under "Levels of Support" beginning on page 22.

answer, then direct support of that particular assembly is justified. This means that some degree of corrective maintenance will be required at the direct support or operational user level. Subsequently, each lower level of assembly will be analyzed until all repairable assemblies or components have been designated for either direct support or potential indirect support.

A repairable assembly designated for indirect support is one which, when a failure or malfunction occurs, is removed and replaced by an identical spare assembly at the operational level, while the required corrective maintenance is provided at an indirect support level. At this point in the decision network, however, all assemblies are designated for potential indirect support unless it has been demonstrated that direct support is essential for non-economic reasons. All potential indirect support items are then subjected to an economic analysis as depicted in box (4). Before the economic analysis takes place, however, the third principal analysis of the decision network must be made as indicated in boxes (3a) and (3b) of Figure 1.

The third principal analysis is one of identifying non-economic constraints over the decision process and various support elements and options which should be considered. This analysis can best be described in two parts. The first part is the identification of potential non-economic constraints shown as box (3a) on Figure 1. These constraints are factors which might affect the final decision but are difficult to quantify in economic terms; they might include such things as quality of repair, control over the operation, availability of transportation during wartime, responsiveness to demand, or maintaining an industry base for emergency. Some such constraints may be identified during the repair vs. discard or support level essentiality analysis. Others may

not become apparent until various support elements and options have been analyzed.

The second part of the third principal analysis is an identification of support elements and options to be considered as shown in box (3b) of Figure 1. This identification process is discussed in more detail under "Elements of Support" beginning on page 14 and is illustrated in Table 1, page 17. The result of this identification process is to develop with respect to each repairable assembly a description of various available support options including those in the time dimension.

The fourth principal analysis then is the economic analysis, box (4), which calculates the cost to the government of each support element identified in box (3b). The fifth principal analysis evaluates the cost of each support option against any non-economic constraints which may have been identified earlier in box (3a); the result is a decision to subject the repairable assembly to direct support or one of the indirect support options. Whatever the decision, at this point plans and arrangements should be made to provide the required support in the most timely and efficient manner.

In the case of a new system in the introductory phase of the life cycle, there may be investments already made in development and production equipment, facilities, and personnel which could be used to provide support for a temporary period of time. It might also be desirable to delay the support decision until more reliable economic and technological data associated with a new system can be compiled. In either case it may be advantageous to rely on interim contractor support. Thus, the final analysis may be called a decision priority analysis as shown in box (6) of Figure 1. This analysis assesses the capability of the contractor to

provide support utilizing the equipment, facilities, personnel, and organization required for development, test and production of the new system. The result of the analysis is to establish a date during the introductory phase with respect to each repairable assembly at which the contractor can meet both production commitments and support requirements. These dates are then used to establish a time-phased priority for making support decisions. It is anticipated that the assemblies which would normally be subjected to this type of analysis would be those requiring costly investments in special tools, handling or test equipment.

2. Analytical Guidelines and Models

a. Repair vs. Discard Analysis: Analytical models for making this analysis are not presented in this report, but can be found in another LMI report, "Criteria for Repair vs. Discard Decisions," LMI Task 65-15, May 1966.

b. Support Level Essentiality Analysis: Three alternate methods are suggested for making this analysis. These are:

- Method 1 -- Judgment by Assembly Level
- Method 2 -- Qualitative Factor Analysis
- Method 3 -- Quantitative Factor Analysis

(1) Judgment by Assembly Level -- The first method is the simplest and consists of making qualitative judgments with respect to each repairable assembly. If a particular repairable assembly is justified for direct support, then its sub-assemblies are analyzed; this process continues until a level of assembly is reached where direct support is not essential. Some qualitative examples which might affect direct support essentiality are:

- Remove and replace time excessive.
- Transportation to an indirect support source under operational conditions not likely to be available or reliable.
- Remove and replace operation not normally required to facilitate corrective maintenance.
- Remove and replace operation difficult.
- Remove and replace operation requires special tooling, handling or test equipment.
- Required number of spares under a remove and replace policy is a detriment to mobility (e.g., results in excessive space requirements, weight, etc.).
- Corrective maintenance actions normally minor.
- Equipment has high failure frequency.
- Planned strategic or tactical operation of equipment prohibits frequent re-supply of spares (e.g., sustained operation in isolated environment required).

Method 1 should be used when the reasons for providing direct support are fairly apparent, or when mission effectiveness or operational readiness is not significantly affected by the type or amount of support provided at the direct support level.

(2) Qualitative Factor Analysis -- A more precise method is to make a Qualitative Factor Analysis, Method 2. This method evaluates direct support of various subassembly combinations with respect to certain factors known to have a significant effect on mission effectiveness or operational readiness. For example, suppose we have a particular assembly (A) which consists of three major subassemblies, which in turn consists of several components each as shown in Figure 2.

FIGURE 2

ILLUSTRATIONS OF ASSEMBLY SUPPORT COMBINATIONS

Assembly Breakdown	Assembly Support Combinations	
A	1.	A
A ₁	2.	A ₁ + A ₂ + A ₃
A _{1.1}	3.	A ₁ + A ₂ + A _{3.1} + A _{3.2}
A _{1.2}	4.	A ₁ + A _{2.1} + A _{2.2} + A _{2.3} + A ₃
A ₂	5.	A ₁ + A _{2.1} + A _{2.2} + A _{2.3} + A _{3.1} + A _{3.2}
A _{2.1}	6.	A _{1.1} + A _{1.2} + A _{2.1} + A _{2.2} + A _{2.3} + A _{3.1} + A _{3.2}
A _{2.2}	7.	A _{1.1} + A _{1.2} + A ₂ + A ₃
A _{2.3}	8.	A _{1.1} + A _{1.2} + A ₂ + A _{3.1} + A _{3.2}
A ₃	9.	A _{1.1} + A _{1.2} + A _{2.1} + A _{2.2} + A _{2.3} + A ₃
A _{3.1}		
A _{3.2}		

In this example there are nine possible assembly support combinations as illustrated. Applying the qualitative factor analysis method each support combination would be evaluated and ranked in terms of specific factors which affect mission-effectiveness or operational readiness as illustrated in Figure 3. In the illustration, combination (4) is the most desirable from a mission effectiveness point of view. Combination (4) is to provide direct support only for sub-assembly A_2 ; hence, A_2 would be designated for direct support while subassemblies A_1 and A_3 would be subjected to economic analysis to determine the optimum support option.

(3) Quantitative Factor Analysis -- The third method of making the support level essentiality analysis is the same as the second method except that the essentiality factors are evaluated in quantitative measures. The third method should be used where it is possible to relatively weight the essentiality factors or where it is desirable to make economic tradeoffs between the costs associated with each support combination and the effects that each combination may have on mission effectiveness.

c. Identification of Support Elements and Options. There are no particular guidelines presented for this analysis. The identification of support elements and support options to be considered is basically a matter of good judgment.

d. Economic Analysis. The economic analysis employs a general economic model which can be used to calculate the cost to the government of providing certain support elements from various optional sources. The general economic model is:

FIGURE 3

ILLUSTRATION OF SUPPORT LEVEL ESSENTIALITY ANALYSISMETHOD 2 -- QUALITATIVE FACTOR ANALYSIS

Assembly Support Combinations	ESSENTIALITY FACTORS			
	Down time E_1	Weight E_2	Support Equip- ment E_3	
1)	Hi	Hi	Lo	
2)	Med	Med	Lo	
3)	Med	Hi	Hi	
4)	Lo	Lo	Lo	MOST EFFECTIVE COMBINATION
5)	Lo	Med	Hi	A_1 → Potential Indirect
6)	Med	Med	Hi	
7)	Lo	Hi	Med	$A_{2.1}$ $A_{2.2}$ $A_{2.3}$ A_2 → Direct Support Essential
8)	Lo	Med	Med	
9)	Med	Lo	Lo	A_3 → Potential Indirect

$$\text{Cost} = \left(\begin{array}{c} \text{Pipeline} \\ \text{spares} \\ \text{invest-} \\ \text{ment at} \\ \text{user} \\ \text{level} \end{array} \right) + \left[\left(\begin{array}{c} \text{Unit} \\ \text{repair +} \\ \text{cost} \end{array} \right) + \left(\begin{array}{c} \text{Unit} \\ \text{hand-} \\ \text{ling} \\ \text{cost} \end{array} \right) + \left(\begin{array}{c} \text{Failure} \\ \text{fre-} \\ \text{quency} \\ \text{per} \\ \text{year} \end{array} \right) + \left(\begin{array}{c} \text{Cost per} \\ \text{year of} \\ \text{pertinent} \\ \text{support} \\ \text{elements} \end{array} \right) \right] \left(\begin{array}{c} \text{No. of} \\ \text{years} \\ \text{consid-} \\ \text{ered} \end{array} \right)$$

Using mathematical symbology the economic model may be expressed as:

$$C_i = Uft_i + \left[(m_i + H_i) f + B_i \right] P$$

where

C_i = the cost to the government of providing support via the i th support option

U = the unit cost of the assembly being analyzed

f = the anticipated number of failures per year of the assembly being analyzed

t_i = the repair turnaround time in years associated with the i th support option

H_i = the mean unit handling cost from point of use to point of repair and return associated with the i th support option, including packaging, packing, shipping, transportation and receiving

B_i = costs per year of all pertinent support elements considered which are incurred under the i th support option, including facilities, special support equipment, management and administration, training, and documentation. (Note: the factors comprising this category of costs will vary depending on the support elements and options being considered.)

P = the number of years over which the costs of various support options are to be analyzed

The costs are calculated for each support option being considered with respect to each repairable assembly that is a candidate for indirect support. The costs are then compared

to select the optimum support combination which will result in the lowest cost to the government.

The economic model is structured to enable consideration of all support elements. However, in the interest of simplicity all support elements which can reasonably be expressed in terms of cost per year and are additive have been included in a single factor, B_i . If various support options are to be considered exclusively for a single element of support included in B_i , and such support has no effect on pipeline spares required at the user level or is itself not affected by failure frequency, then all factors other than the support element considered should be given a value of zero.

The analytical method is illustrated in Figure 4. Suppose three support options -- C_0 , C_1 and C_2 -- are being considered with respect to Assembly A_1 which consists of two subassemblies, $A_{1.1}$ and $A_{1.2}$. Suppose further that the costs under each support option are calculated and the results are shown in Figure 4. If A_1 is considered alone, then support option C_2 represents the lowest cost -- \$180K in this case. However, an alternative would be to support subassembly $A_{1.1}$ under one support option and subassembly $A_{1.2}$ under another. In this case, support option C_0 represents the lowest cost for subassembly $A_{1.1}$ and support option C_2 for subassembly $A_{1.2}$, the sum of which is less than \$180K. Therefore, the optimum support combination in this illustration would provide direct support (C_0) for subassembly $A_{1.1}$ and indirect support (C_2) for subassembly $A_{1.2}$.

FIGURE 4

ILLUSTRATION OF APPLYING RESULTS OF ECONOMIC MODEL

Assembly Level	Support Options			Optimum Support Combination
	Direct C_0	Indirect C_1	C_2 Lowest Cost	
A_1	200K	220K	180K	C_2 Direct (C_0)
$A_{1.1}$	70K	150K	120K	C_0 Direct (C_0)
$A_{1.2}$	130K	70K	60K	C_2 Indirect (C_2)

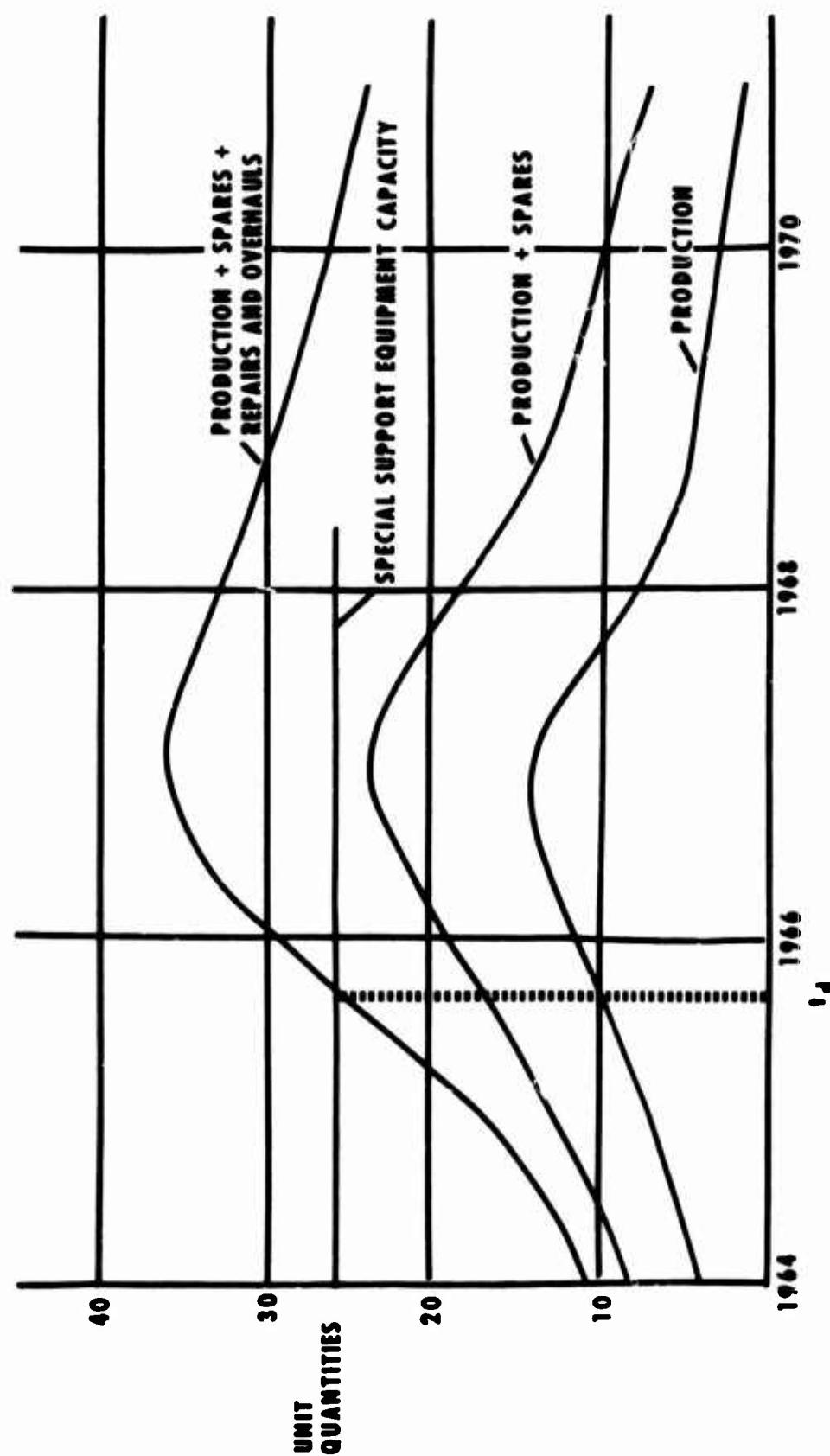
e. Decision Evaluation. At this point, the economics of various support options are considered together with any non-economic constraints which may exist. An attempt should be made wherever possible to weigh such constraints in economic terms. In any event the final decision must be made on the basis of sound judgment.

f. Decision Priority Analysis. The objective of this analysis is to determine a point in time during the introductory phase where the contractors' production capacity is sufficient to meet production, spares, overhaul and repair requirements. Figure 5 graphically illustrates the point in time (t_d) which is to be determined for certain repairable assemblies. The guidelines for making this analysis are:

- (1) Identify those assemblies which require special support equipment (SSE) which is common to production, repair and overhaul requirements.

FIGURE 5

GRAPHIC ILLUSTRATION OF DECISION PRIORITY ANALYSIS



- (2) Determine the units of capacity of the SSE required to meet peak production commitments.
- (3) Determine units of production requirements including spares, as such requirements vary with time.
- (4) Determine units of overhaul and repair requirements as such requirements vary with time.
- (5) Determine the time (t_d) which satisfies the following relationship:

$$\frac{\text{SSE Capacity (2)}}{\text{Production and spares requirements (3)} + \text{Overhaul and repair requirements (4)}} = 1$$

3. Potential Auxiliary Benefits

The proposed Support Planning Optimization Technique need not be limited in its application to determining optimum contractor support during the introductory phase of fixed and rotary wing aircraft. It is believed that this type of quantitative approach, if successful, could be effectively applied to serve other areas of interest. First, it would be applicable to all types of weapons systems rather than just fixed and rotary wing aircraft. Second, it could be applied to weapon systems already developed and deployed, although the benefits may not be as great.

A third area of interest where application might prove extremely useful is in the early stages of system development -- prior to the introductory phase. Perhaps as early as "concept formulation" broad application of such techniques could result in the establishment of effective support concepts and design parameters. Following concept formulation, potential

contractors might be requested to apply them in response to "Request for Proposals (RFPs)" for "contract definition." This would provide the government with a more effective and uniform measurement of the contractors' approach. Moreover, the techniques might be adapted for appraising support costs in competition involving life cycle total cost. They might also be applied during the design process; and, in fact, might serve as an aid in justifying engineering changes. Finally, their application might serve as a basis for entering into a total package procurement. It would appear that such auxiliary areas of application warrant further investigation.

EXHIBIT I

ASSISTANT SECRETARY OF DEFENSE
Washington, D. C.

68

Installations and Logistics

DATE: 6 July 1967

TASK ORDER SD-271-77
(TASK 68-2)

1. Pursuant to Articles I and III of the Department of Defense Contract No. SD-271 with the Logistics Management Institute, the Institute is requested to undertake the following task:

A. TITLE: Contractor Support of Fixed and Rotary Wing Aircraft Weapon Systems

B. SCOPE OF WORK: In this study the differences in Army, Navy and Air Force practices of utilizing contractor support during the test, evaluation and initial introduction period of fixed and rotary wing aircraft weapon systems will be considered. The objective of the task is to evaluate the practices of the Services and to recommend a "best" method. It will be determined whether peculiarities of missions justifies present differences in these practices.

In accomplishing this task LMI will:

1) Identify the present procedures of the Services for defining and utilizing contractor support.

2) Determine the availability of data useful in evaluating contractor support.

3) Compare the methods used by the Services.

4) By trade-off analysis techniques evaluate the various Service methods and arrive at an optimal technique.

2. SCHEDULE: A study plan will be completed within one (1) month from the date of this task order, and an oral progress report will be made three (3) months thereafter. A final written report will be submitted within six (6) months of the date of this task order.

/s/ Paul R. Ignatius

ACCEPTED /s/ Barry J. Shillito

DATE July 6, 1967

EXHIBIT II

LIST OF DOCUMENTS REVIEWED

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