PBBE

Performance-Based Business Environment

Flexible Sustainment Guide

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JOINT LOGISTICS COMMANDERS

JOINT AERONAUTICAL COMMANDERS' GROUP

Departments of the Air Force, Army, Navy
United States Coast Guard
Defense Logistics Agency
National Aeronautics and Space Administration
Federal Aviation Administration

Performance-Based Business Environment (PBBE)

Flexible Sustainment Guide

SUMMARY OF CHANGES

Changes to the Flexible Sustainment Guide dated 23 January 1997 and Change 1 dated 14 August 1997 are as follows:

- Changed the term "Trigger Based Item Management (TBIM)" to "Trigger Based Asset Management (TBAM)"
- Integration of Space Sector Requirements
- Integrated the Open Systems approach
- Integrated the Depot Maintenance Decision Process
- Included Logistics Management Information (LMI) references and Performance Specifications
- Incorporated Deficiency Reporting Process references and guidance
- Included guidance on Total Ownership Cost (TOC)
- Provided Internet Address for the On-Line Automated Flexible Sustainment Tool
- Changed the term in Section 4 from Re-Procurement to Procurement Alternatives

- Included hot links to web pages wherever possible and appropriate
- Combined Appendix I (Triggers), into Section 3 (Triggers)
- Deleted Appendix A (Use of Performance-Based Specifications) is now part of Product Definition Guide
- Deleted reference to Contractor Performance Assessment Report (CPAR), now service specific
- Updated all illustrations as a result of major section revisions
- Included information and links to the Maintenance Trade Cost Guide (BCA)
- Included information on new approaches to long term contracting (Award Term)
- Updated Acronym Appendix

FOREWORD

In today's global economy, the military advantage will go to the nation that can best capture technologies that are commercially available, incorporate them in weapon systems and field new operational capabilities. The focus on commercial support of military aviation alternatives is driven by the force modernization needs faced by each of the services at a time when resources for acquisition of new defense systems are increasingly constrained. These resource limitations are very real and are not likely to diminish greatly in the foreseeable future

Of even greater import for the nation's force modernization needs is the unevenness within the DoD budget with which these resource reductions have occurred. Whereas the overall DoD budget has declined by 28 percent since 1990, procurement spending has dropped by 53 percent, while operations and maintenance activities have declined by 15 percent.

The procurement lull in new system acquisition, and the increasing reliance on aging platforms far past their original planned life cycle, is expanding the need for a concerted effort to upgrade and update our defense systems. This is a growing need as we prepare to enter the new century. Yet, the options for meeting this force modernization imperative, and for improving overall force readiness, are severely limited.

This trend, if continued unchecked, will diminish our defense program's ability to act as a true deterrent to international aggression, to meet the challenge of regional assignments to which our troops increasingly are deployed, and to effectively prevail in future armed conflicts. Faced with this daunting set of force modernization and resource challenges, civilian and military leaders in the defense community are looking for innovative approaches to logistics support. This would apply to legacy systems, as well as the limited number of new systems that we will acquire in the future, as a means to create savings. These savings will ultimately support force modernization and help ensure the necessary levels of readiness.

Innovative approaches to support of legacy systems, and the integration of logistics support concepts into the acquisition process for new weapons platforms, can be used to produce life cycle savings, reduce cycle times and improve performance. In essence, innovative logistics support can become an enabler for force modernization and aviation system readiness as we seek to prepare for the national security challenges of the 21st century.

The Secretary of Defense's recognized need for a simplified and flexible management framework for translating mission needs into stable, affordable and well-

managed acquisition programs was the impetus for development of this guide. The reduction in Department of Defense (DoD) resources prompted the need for innovative acquisition and sustainment improvements. Flexible sustainment is intended to provide Program Managers with assistance in implementing acquisition reform. This guide offers new and innovative ways to proceed with the DoD acquisition and sustainment processes and contains useful ideas to help accomplish this objective. Material and concepts contained in this guide are included in the DoD Acquisition Deskbook. This guide will be maintained as discretionary guidance.

The Flexible Sustainment IPT, a part of the Aviation Logistics Board, Joint Aeronautical Commanders Group (JACG) meets periodically to assess government and industry recommendations. The goals of the FS IPT are to continually improve the FS Guide and to assist Program Managers in implementing these PBBE initiatives. Please provide all recommended changes to Mr. Jerry Beck, 301-757-8246, email: Beckgr @navair.navy.mil., with a copy to the applicable service or industry representatives:

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EXECUTIVE SUMMARY

In the past, the approach to support of military systems relied on centralized depots. That approach proved effective for the majority of military programs for the last thirty years. During that time the military had often taken the lead in Research and Development (R&D) of new systems and technologies. Many commercial companies got their start through the development of key technologies (transistors, radio, radar, aviation, and space exploration), that were found by organizations such as ARPA, NASA, Man Tech, and the National Laboratories. The support structure was required to be in-place for as long as the military had a need for the system, which proved very beneficial for the development of commercial systems, which could rely on spare parts, system improvements, and the general infrastructure, without paying for the development of such systems.

The demand for advanced commercial systems has currently surpassed the capacity of the military R&D houses and the commercial marketplace is replacing the military with internal R&D investments, teaming with universities or foreign governments. Many of the firms which supplied the basic components to the military, having found their profit margins restricted and new programs dwindling, have decided to refocus their markets into commercial endeavors and away from military systems. Military programs must now learn to adapt and follow commercial systems and commercial R&D investments. The processes identified within Flexible Sustainment provide the ability for current military systems to be supported for their life cycles without the expense of the military developmental investments.

Flexible Sustainment (FS) is a process that encourages the Program Manager (PM) to use performance-based specifications and to develop innovative, cost-effective, life cycle solutions. This guide was developed as a result of Joint Aeronautical Commanders Group (JACG) action to implement the Performance-Based Business Environment (PBBE) initiatives, and to address the many various acquisition reform initiatives.

Supportability analyses, including comparison of commercial and organic cost-effective capability, should be conducted as an integral part of the systems engineering process. As DoD's role continues to shift from that of being a technology producer to being a technology consumer, program managers are likely to rely more on commercial products to meet the users' requirements. This requires Program Managers to ensure application of a rigorous system engineering process that incorporates open systems concepts and principles. It ensures delivery of systems that more readily accommodate commercial products whose design is not controlled by DoD and whose lifetimes are much shorter and more volatile than the systems they support. This effort needs to begin at program initiation and continue throughout program development (design for support). FS introduces two follow-on processes:

- The first is Reliability Based Logistics (RBL), which suggests that increasing the inherent reliability of a system can result in significant reduction of the maintenance support structure. RBL is intended to assist the program managers in developing the best "design for support" solution.

- The second is Trigger Based Asset Management (TBAM), which recommends assessment of fielded systems trends and a re-examination of the maintenance plan when "triggers" (such as changes in reliability or maintainability trends, a change in technology, or diminishing resources) are detected. TBAM is a cost-effective tool to enable the team to "support the design".

In addition to RBL and TBAM, other innovative support solutions, such as procurement of Form-Fit-Function-Interface (F^3I) spares, performance warranties, and obsolescence assessment are presented as cost-effective support alternatives.

The rapid rate of technological advances is an important opportunity that the DoD must effectively exploit to keep its leadership edge in technology. However, it also poses a threat if DoD lacks the capability to leverage on commercial market investment in new technology and continues to use unique specifications and standards in building new weapon and information systems. DoD is no longer the driving force behind technological breakthroughs and consequently is in no position to set standards and mandate the industry to follow them. Moreover, use of open systems has become the preferred strategy by manufacturers of large and complex commercial systems. Senior DoD management has seized upon this move to open systems as a way to leverage, for DoD systems, the tremendous investment of the commercial sector.

DoD senior management has directed components to explore reasonably modifying performance requirements to facilitate the use of open standards and develop standards based architectures in designing systems. The guidance establishes the open systems (OS) approach as one of the best practices for avoiding imposing unique requirements and clarifies the use of open systems as an essential element of a program's acquisition strategy and a means to foster competition. The guidance also stipulates that commercial and non-developmental items have open interfaces to the maximum extent affordable based on life cycle considerations. Through the use of open systems concepts, DoD can:

- reduce life cycle costs of systems,
- maintain affordable superior combat capability,
- upgrade systems using new technology with less complexity and in shorter cycles,
- be resilient to changes in technology throughout the life of systems, and
- mitigate obsolescence problems caused by the shortened technology life cycles of today.

Detailed information on open systems, guidance documents and lessons learned in the application of open interface standards are available at http://www.acq.osd.mil/osjtf.

The FS Guide is one in a series of PBBE documents sponsored by the JACG to provide a set of guiding principles, which embraces the basic tenets of acquisition reform. These products are intended to facilitate implementation of the Secretary of Defense's memos of 29 June 1994 and 10 May 1995 in accordance with the new DoD Directive 5000.1 and DoD Regulation 5000.2-R.

The purpose of this guide is to provide a methodology to acquaint the user with an understanding of the Flexible Sustainment (FS) Process. This approach helps integrated program management teams implement the tenets of acquisition reform. It includes a linking mechanism identifying effective weapon system program management tools, data sources, supportability analyses models, and cost estimating techniques to enable Total Ownership Cost (TOC) reduction. Industry and DoD users are provided direct access to their respective acquisition and sustainment tools and processes to provide the necessary data to accomplish the analyses. This methodology enables program teams to develop cost-effective alternative support solutions using a structured and repeatable process.

Section 1 provides background on Flexible Sustainment, defines terms, and describes benefits derived by implementing FS. This is followed by a discussion in Sections 2 and 3 of two major processes, RBL and TBAM. These processes provide acquisition and support personnel with proactive guidance, such as implementing an OS approach and focusing on Total Ownership Cost (TOC) when dealing with potential sustainment problems. Finally, Section 4 provides a strategy for the spares Procurement process. In addition, nine appendices supplement this guide as follows:

Appendix A. Non-Economic Driver Determination Process - Describes non-economic factors that influence the level of maintenance.

Appendix B. System/Component Reliability - Provides a synopsis of top-level reliability descriptors.

Appendix C. An Integrated Approach to Managing Aging Technology - Presents an approach to provide more comprehensive decision support information to effectively manage the impact of evolving technology and resulting Diminishing Manufacturing Sources - Material Shortages (DMSMS) and how an OS approach may help manage these problems.

Appendix D. Use of Warranties - Provides guidance on the selection and use of appropriate types of warranties.

Appendix E. Use of Incentives - Provides guidance on contracting techniques to encourage the contractor to increase system performance.

Appendix F. Logistics Operations Cost - Provides an overview of repair level analyses that impact maintenance planning and sustainment processes.

Appendix G. Assessing Potential Source/ Product Qualifications - Guidance used to assist acquisition managers in selecting lower risk sources.

Appendix H. Trigger Sources - Lists potential triggers and recommended data sources.

Appendix I. Acronyms - Acronyms used in this guide.

SECTION 1 BACKGROUND

1.1 History. The Department of Defense (DoD) Flexible Sustainment Guide is a product of recent acquisition reform efforts, specifically, the Secretary of Defense's memorandums dated 29 June 1994 and 10 May 1995, which emphasize Performance-Based specifications as a cost-effective way of doing business. In addition, this guide addresses the use of open systems (OS) specifications and standards as directed by the Under Secretary of Defense (Acquisition & Technology) in a memorandum, dated 29 November 1994. His direction to use open systems specifications and standards to the greatest extent possible in the acquisition of weapon systems furthers the goals of military specification and standard reform established in the Secretary of Defense's 29 June 1994 memorandum cited above.

1.1.1 Issue. Reduced government funding and manpower levels have further emphasized the need to improve management of acquisition and support processes. This necessitates an increased awareness of efficiency and cost-effectiveness by Program Managers. New ways must be found to support operational commanders effectively while remaining within budget constraints.

1.1.2 Objectives. Flexible Sustainment (FS) provides Program Managers (PM) with the opportunity to reduce life cycle costs in the following ways: (1) by conducting supportability analyses as part of the systems engineering process to implement the most life cycle cost-effective operational and support system; (2) by improving the reliability of existing systems and reducing operations and support (O&S) costs; and (3) by facilitating technology insertion throughout the life cycle. Implementation of FS initiatives will enable DoD components the opportunity to reduce life cycle costs and provide needed funds for modernization and recapitalization.

1.2 Organizational Overview. In response to the Secretary of Defense's 29 June 1994 memo, the Commander of the Air Force Materiel Command (AFMC) chartered the Non Governmental Standards Integrated Program Team (NGS-IPT) in September 1994. The NGS-IPT focused on seven principal areas: supplier past performance, supplier rating system, supplier key processes, single process facilities, training integration, training systems, and flexible sustainment. The NGS-IPT results in these areas were transitioned to the Joint Aeronautical Commanders Group (JACG) for further consideration, development, and deployment. Each area was assigned to a JACG process board. The FS area was transitioned to the Aviation Logistics Board (ALB). During its first meeting in November 1995, the ALB's Flexible Sustainment Sub-Group decided to produce a "DoD Flexible Sustainment Guide". It is intended to assist working-level managers to understand the concepts of FS.

The FS Guide is one of several documents to be used in conjunction with other PBBE products. Other PBBE guides include:

- Integrated Performance-Based Business Environment Guide
- Risk Management Pamphlet
- Performance-Based Product Definition Guide
- Joint Service Specification Guides (JSSG)
- Key Supplier Processes Handbook
- Performance Risk Assessment Group (PRAG) Guide

1.2.1 Flexible Sustainment (FS) Guide. This guide focuses on innovative FS concepts and provides guidance to Program Managers for consideration and use. Two new reliability-based processes have been identified and are introduced in this FS guide. These two processes are a compilation of various techniques and methodologies being used by various DoD and industry components. They are interrelated and complement each other. The first, Reliability Based Logistics (RBL), deals with both acquisition and post production support. The second process is Trigger Based Asset Management (TBAM), which applies to fielded systems. In addition to RBL and TBAM, other innovative support solutions, such as procurement of Form-Fit-Function-Interface (F^3I) spares, performance warranties, and obsolescence assessment, are presented as cost-effective support alternatives. Application of these concepts can result in efficiency improvements in the acquisition process and reduction of life cycle costs. Both processes recommend maximum consideration of commercial industrial capabilities to obtain the most cost-effective support solution.

1.2.2 Statutes. The following are extracts from Chapter 146, Title 10, USC Code, which relate to DoD depot maintenance support. The Flexible Sustainment approach should be implemented within the confines of these statutes.

10 USC 2461. Commercial or industrial type functions: required studies and reports before conversion to contractor support;
10 USC 2462. Contracting for certain supplies and services required when cost is lower;
10 USC 2463. Reports on savings or costs from increased use of DoD civilian personnel;
10 USC 2464. Core Logistics Functions;
10 USC 2466. Limitations on the performance of depot-level maintenance of material;
10 USC 2469. Contracts to perform workloads previously performed by depot-level activities of the Department of Defense: requirement of competition;
10 USC 2470. Depot-level activities of the Department of Defense: authority to compete for maintenance and repair workloads of other Federal agencies;
10 USC 2471. Persons outside the Department of Defense: lease of excess depot-level equipment and facilities by; P.L. 99-145, Section 1231. Core logistics functions subject to contracting out limitations; and
P.L. 103-335, Section 8057. Certification of costs in public-private competition.

Note: The Depot Maintenance Decision Process must be used to determine the source of repair for each depot level reparable. This process ensures that each service is in compliance with the Title 10, 2464 and 2466.

1.3 Definitions.

1.3.1 10 USC 2464, Core: Requires that each service maintain a core logistics capability that is government owned and government operated. Core logistics capabilities include those capabilities that are necessary to maintain and repair the weapon systems and other military equipment (including mission-essential weapon systems or materiel) as necessary to enable the armed forces to fulfill the strategic and contingency plans. Those Core logistics capabilities must be established not later than four years after achieving initial operational capability. Each Service uses the DoD core methodology to determine the core requirements for the contingency plan.

1.3.2 10 USC 2466 (50/50) Contracting Limitations. Not more than 50 percent of funds made available in an FY to a MILDEP or defense Agency for Depot level maintenance and repair workload may be used to contract for the performance by non -federal government personnel, this includes ICS and CLS. Excludes procurement of major modifications or upgrades and procurement safety modifications but includes installation. WWW.afmc.wpafb.af.mil/organizations/HQ-AFMC/LG/lgpy.htm

1.3.3 Business Case Analysis (BCA). Provides the foundation for making cost-effective decisions regarding the use of commercial support for DoD weapon systems. However, a well-structured BCA also provides a methodology to fully define the nature and scope of the application and transition from current support to the new commercial application. It serves as an essential source of proposed alternative information and its impact on the existing DoD support infrastructure. It becomes the source of cost and performance baseline data for structuring and managing the implementation of the commercial support solution.

1.3.4 Commercial Item. A commercial item is defined as any item, other than real property, that is of a type customarily used for non-governmental purposes and that: (1) has been sold, leased, or licensed to the general public; or, (2) has been offered for sale, lease, or license to the general public; or (3) that has evolved through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a government solicitation. Also included in the definition are services of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions. This does not include services that are sold based on hourly rates without an established catalog or market price for the specific service performed

1.3.5 Cost As an Independent Variable (CAIV) a formal DoD acquisition policy mandated by DoD Directive 5000.1, Defense acquisition, and DoD 5000.2-R, Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information Systems Acquisition Programs. Its philosophy is very similar to Life Cycle Logistics (LCL) in that it optimizes life cycle cost during the development phases via trade-offs. It is defined as the methodologies used to acquire and operate affordable DoD systems by setting aggressive, achievable cost objectives, and by managing efforts to achieve these objectives including trade-offs involving performance and schedule. Cost objectives balance mission needs with projected out-year resources, taking into account anticipated process improvements in both DoD and industry to meet the most critical user requirements.

1.3.6 Depot Maintenance Decision Process. Provides an efficient and effective depot source of repair process that considers all available resources. The objective of the process is to evaluate the organic verses contract source of repair for depot level reparables and reduce weapon systems costs for depot activation and recurring support. The acquiring DoD component logistics head using the SOR decision logic process shall make depot Maintenance Source of Repair (SOR) Assignments. This decision shall be made within 90 days of EMD contract award or sooner, such assignments shall be consistent with depot maintenance policy and DOD 5000.2.

1.3.7 Design Interface. The acquisition logistics interface with the design process is through the systems engineering process. Supportability must be considered as part of the requirements generation and analytical activities and continue through design, test and evaluation, production and fielding. The early focus should result in the establishment of support related design parameters. These parameters should be expressed both quantitatively and qualitatively in operational terms and specifically relate to readiness objectives and the support costs of the system.

1.3.8 Flexible Sustainment (FS). FS is a decision point driven process to implement acquisition reform in an orderly manner and to optimize investment strategies for support. FS introduces two new sub-processes, RBL and TBAM. In addition, other innovative support solutions, such as procurement of Form-Fit-Function-Interface (F^3I) spares, performance warranties, and obsolescence assessment are presented as cost-effective life cycle support alternatives.

1.3.8.1 Reliability Based Logistics (RBL). RBL is a process, which recognizes the importance of designing reliability into systems in order to reduce the fielded maintenance support infrastructure. Specifically, RBL addresses whether an item should be treated as a consumable or a repairable; commercial versus organic repair decisions; the method of support as a function of cost-effectiveness, considering the item's reliability, its technology cycle, and the useful life of the item.

1.3.8.2 Trigger Based Asset Management (TBAM). TBAM is a proactive approach to assess fielded systems trends and re-examine the support structure when "triggers"

(such as a change in reliability or maintainability, change in technology, or diminishing resources) are detected. These triggers enable Integrated Program Teams (IPT) to take appropriate action before a support issue becomes critical.

1.3.8.3 Procurement. Consists of three available options, 1. Build to Print (BTP), 2. Modified Build to Print (MBTP) and 3. Form, Fit , Function, Interface(F^3I)

1.3.8.3.1 BTP. Build-to-Print procurement acquires parts that are identical to the original parts with only approved changes allowed by the Government to be incorporated into the new items. While this process is very inflexible with regards to incorporating design changes and emerging technologies, it does reduce the inherent risks involved with new/changed designs.

1.3.8.3.2 MBTP procurement allows process changes, which do not denigrate performance or fit, otherwise it provides a product equivalent in material and is consistent with the original design. MBTP is used when the supplier has proven past performance and is thereby given flexibility to change manufacturing processes only.

1.3.8.3.3 F^3I Form-Fit-Function-Interface (F^3I). F^3I is a mechanism to link design to performance requirements i.e. replacing an item/system based on form, fit, function and interface characteristics. It does not specify material or support characteristics unless they are requirement/interface driven. This capability can reside in the same organization, either government or industry. Key product performance characteristics and product acceptance criteria are specified; but there is flexibility to change the design while meeting performance requirements, as well as flexibility to change the manufacturing processes to produce the design. The end item performance must be verified to be unaffected by the design and/or process change. These changes must consider total life cycle cost impacts as part of the overall decision process. Again, prior customer approval of changes may or may not be required depending on the demonstrated capability of the supplier. Technology insertion without the need for equipment modification can often be accomplished with commercial substitutes (as defined below).

1.3.9 Life Cycle Logistics (LCL). LCL is a means of using supportability and affordability tradeoffs during the systems engineering process which can optimize acquisition of logistics and Operations and Support (O&S) costs while providing the best support package for our operational forces. In addition to cost, other factors may affect the trade-off process, such as changing mission requirements, new technology, and component obsolescence. Assessment of cost-effective life cycle support tradeoffs should be accomplished throughout the life of the system.

1.3.10 Logistics Management Information (LMI) Consists of MIL-PRF-49506, Performance Specification, Logistics Management Information, and Acquisition Logistics Handbook, MIL HDBK 502. MIL-PRF-49506 provides the DoD with a contractual method for acquiring support and support related engineering and logistics

data from contractors. Data is used in existing DoD infrastructure management processes such as initial provisioning, cataloging, and item management. http://www.logpars.army.mil/alc/LogEngr.htm

1.3.11 Logistics Reliability. A measure of the ability of an item to operate without placing a demand on the logistics support structure for repair or adjustment. Logistics reliability recognizes the effects of occurrences that place a demand on the logistics support structure without regard to effect on function or mission.

1.3.11.1 Mission Reliability. A measure of a system's ability to complete its mission. It considers only failures that cause mission abort. It is improved by redundancy and is usually higher than Logistics Reliability.

1.3.12 Maintenance Planning (MP). Maintenance planning includes all the planning and analyses associated with the establishment of requirements for the overall support of a system throughout its life cycle. It includes a sustaining level of activity commencing with development of the maintenance concept continuing through the accomplishment of logistics support analyses and the acquisition of support teams integrating the various facets of support. By using the Reliability Centered Maintenance (RCM) methodology early in the Maintenance Planning stages and throughout the system's life, an inherently reliable system with well-designed preventive maintenance tasks should result. RCM is a management process of arranging all elements of maintenance support necessary for system/equipment to meet mission requirements. This process identifies maintenance tasks to be accomplished and time phasing for all levels of maintenance, including both preventive and unscheduled maintenance. It includes planning for various scenarios and environments throughout the life cycle of the weapon system. It establishes the maintenance and repair (organic and/or commercial) concepts that trace logistics requirements to the operational and supporting commands. http://www.nalda.navy.mil/rcm

1.3.13 Maintenance Trade Cost Guide assists in the preparation and evaluation of cost analyses for alternative maintenance concepts under consideration to reduce DoD operating and support costs. The primary objective of the guide is to achieve comprehensive, consistent, well-documented cost estimates that can be replicated and independently verified. A key objective is to assist program management in the identification and use of all required cost elements, the best source of cost data and an awareness of reliable cost estimating methodologies. http://www.navair.navy.mil/air40/air42/Overview/reference/reference.html

1.3.14 Modified Commercial Item. A modified commercial item is any item with modifications of a type customarily available in the commercial marketplace; or modifications of a type not customarily available in the commercial marketplace made to meet federal government requirements. Such modifications are considered minor if the change does not significantly alter the non-governmental function or essential

physical characteristics of an item or component. Factors to be considered in determining whether a modification is minor include the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts, but are not conclusive evidence that a modification is minor.

1.3.15 Non-Developmental Item. A non-developmental item is: (1) any previously developed item of supply used exclusively for governmental purposes by a Federal agency, state or local government, or a foreign government with which the United States has a mutual defense cooperation agreement; (2) any item described in (1) that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or (3) any item of supply being produced that does not meet the requirements described in (1) or (2) solely because the item is not yet in use.

1.3.16 Open Systems (OS). An OS is defined as a system that implements sufficient open standards for interfaces, services, and supporting formats to enable properly engineered components to be utilized across a wide range of systems with minimal changes, to interoperate with other components on local and remote systems, and to interact with users in a style that facilitates portability. OS are characterized by the following:

- well defined, widely used, preferably non-proprietary interfaces/protocols;
- use of standards which are developed/adopted by recognized standards bodies or the commercial market place;
- definition of all aspects of system interfaces to facilitate new or additional systems capabilities for a wide range of applications; and
- explicit provision for expansion or upgrading through the incorporation of additional or higher performance elements with minimal impact on the system.

(Source, OS-JTF 1998 http://www.acq.osd.mil/osjtf/ and the Performance-Based Product Definition Guide, http://www.nalda.navy.mil/jacg)

There are two fundamental precepts in the development of Open Systems:

First, in order to achieve Open Systems, they must be implemented using interface standards that are considered “open.” In short, “open” means that the selected interface standards are characterized as being well defined, widely used, non-proprietary standards that have been developed and are controlled by recognized commercial/professional association standards bodies (i.e. SAE, IEEE) through a consensus based approach. Generally, the marketplace rather than being supported by a single or limited set of suppliers support open interface standards. Figure (x) identifies the range from which interface standards are available for selection and application to programs. Standards that fall in the area encompassed by the oval are considered open and should be given first priority in designing

systems. A rule of thumb is that standards in the upper right quadrant of the figure are the most preferred. In general, when interface standards cannot be selected from the upper right quadrant, it is preferred that standards be selected that are "widely used proprietary" standards in lieu of "narrowly used consensus based" standards.

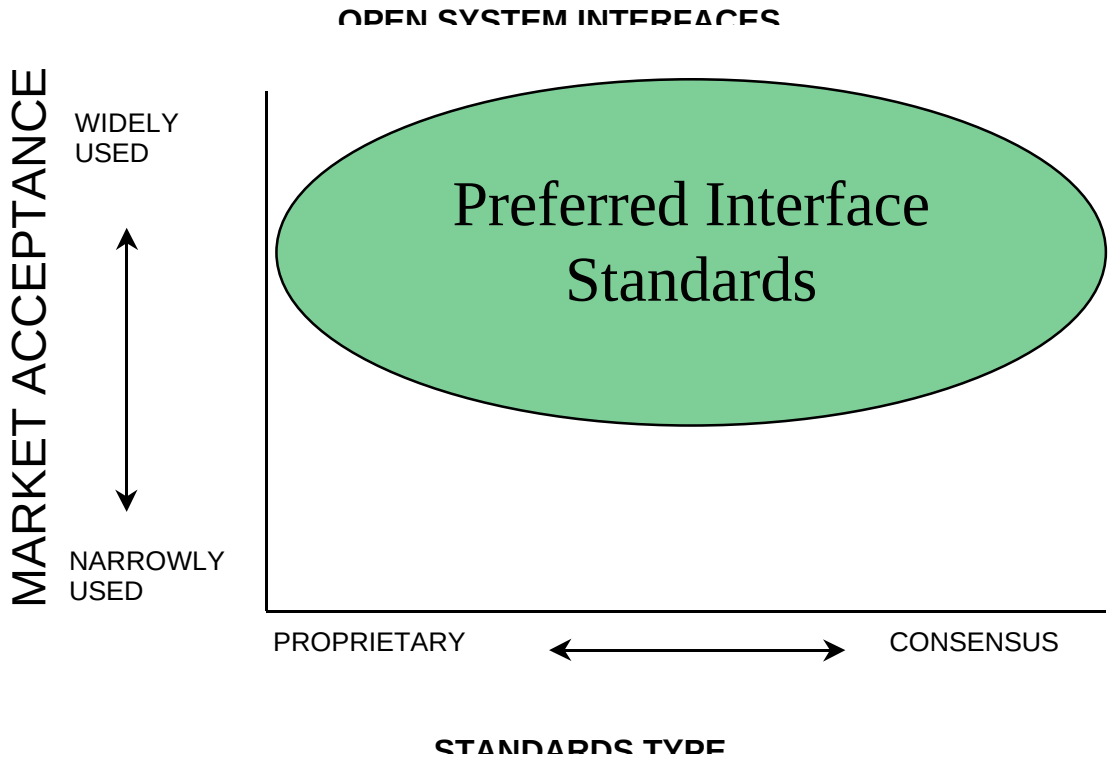


Figure X

The second precept in the use of open interface standards is that their selection must not be arbitrary. They must be selected based on a disciplined systems engineering approach <u>and sound market research.</u> While the benefits from the use of Open Systems can generally only be achieved when using open interface standards, their use might not be prudent in all circumstances. The specific environment and constraints on a program at a given time may necessitate other interface solutions. This situation could occur when procurement of systems is being done using either a Build to Print or a Modified Build to Print procurement strategy. However, in the case of an F3I procurement strategy, use of open interface standards should be given first priority to meet functional requirement or for interface requirements where life cycle affordability gains are evident. On the other hand, most new development systems should be designed based on open interface standards to significant degrees. Several approaches to systems design (i.e. modular, common, COTS) are prevalent, and in many instances are believed to be open. This, however is not a truism. These design

approaches are only open in those cases where they are implemented using open interface standards.

Detailed information on Open Systems, guidance documents and lessons learned in the application of open interface standards are available at http://www.acq.osd.mil/osjtf.

1.3.17 Product Definition Data. Includes the product technical information regardless of form (paper, electronic or other media) that satisfies the content requirements for the Category 1, 2 and 3 data. This data is needed for build-to-print (BTP), modified build-to-print (MBTP), and form-fit-function-interface (F^3I) procurements. Categories defined in PBBE Product Definition Guide: http://www.nalda.navy.mil/jacg

1.3.18 Supportability Analyses. The selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the system engineering and design process, to assist in complying with supportability and other acquisition logistics requirements. This analytical tool is used to determine how to cost-effectively support the system over its entire life cycle, influence system design and program decisions, assess design status, and verify contractor performance.

1.3.19 Sustained Maintenance Planning (SMP). A process that encompasses continual review of established maintenance plans to ensure the most cost-effective, safe maintenance is being performed on in-service support systems. System age, changes in material conditions, failure modes, and the operational environment are continually analyzed to ensure that safe, affordable readiness is maintained. Emphasis is placed on use of Reliability Centered Maintenance (RCM) as a continual life cycle process to establish and adjust preventive maintenance requirements.

1.3.20 System Engineering. A process used to translate operational needs and/or requirements into a system solution that includes the design, manufacturing, test and evaluation, and support processes and products. The systems engineering process shall establish a proper balance between performance (including supportability), risk, cost, and schedule, employing a top-down iterative process of requirements analyses, functional analyses and allocation, design synthesis and verification, and system analyses and control. Refer to the Performance Based Product Definition Guide for additional information. http://www.nalda.navy.mil/jacg

1.3.21 Total Ownership Cost (TOC) includes all costs associated with Research and Development (R&D), Production, Operations and Support (O&S), Disposal and Infrastructure costs of a weapon system including the planning, managing and executing of the w/s program over its full life. http://www.navair.navy.mil/toc http://www.navsea.navy.mil/csea017/toc.htm

1.3.22 Total System Performance Responsibility (TSPR) Contractor assumes responsibility for system performance, support, and cost throughout the program's life cycle. The sustainment infrastructure including hardware and software maintenance,

technical data, support and test equipment (both field and depot), training and training support, supply support, and service engineering, is neither developed to government specifications, nor delivered to the DoD for use and management. The contractor usually maintains Government Furnished Property (GFP) as a part of TSPR. It provides incentives to continuously improve reliability, insert technology, ensure supportability and lower weapon system TOC.

1.4 Integrated Program Team (IPT). This document makes the assumption that the PM has established IPTs as recommended by the Secretary of Defense memo of 10 May 1995. In particular, references are made to an “in-service fielded or in-service support IPT.” The reader must understand that the establishment of IPTs are completely at the discretion of the PM. If necessary, the reader should substitute the correct terminology to describe the members of each in-service fielded or in-service support IPT. In those programs utilizing the TSPR approach, the contractor usually forms and leads the IPT’s.

1.5 Benefits. Program Managers and IPTs should effectively use FS techniques to yield cost savings and improved system performance throughout the life of the system. Program savings are best achieved by an increased emphasis on capturing, controlling and reducing weapon system total cost of ownership. These benefits can be achieved by stimulating a Performance-Based competitive environment, and by increasing maintainability and reliability improvements continually throughout the system’s life cycle.

SECTION 2
RELIABILITY BASED LOGISTICS

2.1 Overview. The two primary processes for Flexible Sustainment (FS) implementation are Reliability Based Logistics (RBL), and Trigger Based Asset Management (TBAM). They complement each other and take maximum advantage of commercial industry capabilities and practices. Successful application of these two concepts can result in improvements in the efficiency of the acquisition process and reductions in total life cycle support costs.

RBL suggests that increasing the logistics reliability of a system can result in significant reduction of the support infrastructure. This will allow for consideration of a more cost-effective two-level maintenance concept, from the organizational level to the Original Equipment Manufacturer/Organic Industrial Facility, vice three levels of support. RBL applies to acquisition and post production support and can be used during the development process to assist in establishing the initial support system. It can also be used during the sustainment phases when TBAM triggers indicate that additional analyses are required. This section provides a fundamental description of the RBL concept and its link to the support planning process.

2.2 Support Planning Process. The first step in logistics support planning is to establish a maintenance concept using guidance provided in the Mission Need Statement (MNS) and the Operational Requirements Document (ORD). This concept is based on meeting unique system requirements, considering the existing logistics infrastructure and achieving the most life cycle cost-effective support solution. This is refined by including supportability analyses in the initial system design trade-off studies, conducting a Business Case Analysis (BCA) and Analysis of Alternatives (AOA) as part of the systems engineering process. Figure 1 provides an overview of the Support Planning Process.

Development of the support plan prior to Engineering & Manufacturing Development (EMD) will enable consideration of supportability requirements to be included in follow-on, Performance-Based specifications and system design trade-off studies. The support process needs to be updated to reflect modifications to the system and changes in the operation and maintenance requirements. This will enable support requirements to reflect the evolution of the operational system. As the life cycle progresses from the EMD phase, it is critical that the maintenance planning process be sustained in order to ensure lowest total life cycle costs of the system.

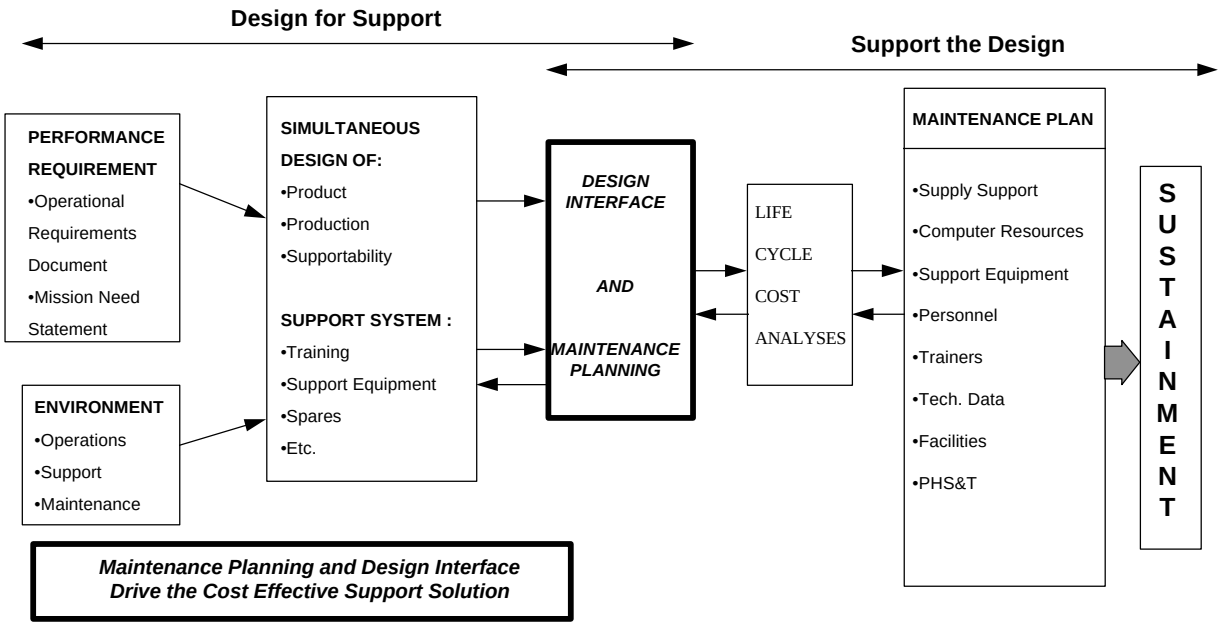


FIGURE 1 ***Support Planning Process***

2.2.1 Design for Support. Ensures that supportability is designed into the system, as opposed to designing support around a system design. Takes into consideration how the system will be sustained over its full life cycle, which for example, an aircraft, is usually much longer than the service life originally planned.

2.2.1.1 Performance Requirements. Are originated by the user and are communicated to acquirers through the Operational Requirements Document (ORD) and Mission Needs Statement (MNS). It is important to do a comprehensive job when determining requirement thresholds and objectives to allow cost, schedule, performance and supportability trade-offs to be made during design.

2.2.1.2 Environment. Is as equally important as performance requirements. The operations, support and maintenance environment can significantly drive-up weapon system Total Ownership Cost (TOC).

2.2.1.3 Design Interface and Maintenance Planning. Design Interface is the relationship between program and logistics support requirements. Supportability considerations should be included in all program trade-off (cost, schedule, and performance) studies, including modifications and updates to the system. In accordance with DoD 5000.2R, performance includes supportability considerations. Linkage to supportability factors as the design evolves is an essential element to develop the most cost-effective support solution. It is important that this interface be included in our Performance-Based specifications.

Maintenance planning is the process conducted to establish maintenance concepts and support requirements for the life of the system. Its goal is to obtain the

most cost-effective life cycle support solution for a system. An integral part of an effective maintenance planning process is the analyses of the operational environment, and potential failure modes effects and criticality of the system in order to determine appropriate preventive maintenance tasks. Continual collection and analyses of readiness data using the Reliability Centered Maintenance (RCM) process for preventive tasks are major factors in implementation of a cost-effective sustained maintenance planning (SMP) program. An OS design may have a significant impact on the maintenance concept and support requirements for the system. Because of the impacts on systems design and the long term Operations and Support (O&S) cost implications, a cost-effective support concept needs to be established early in the program after careful consideration of all viable alternatives and refined concurrently with the design effort into detailed maintenance plans.

2.2.1.4 Life Cycle Cost Analyses. Special emphasis should be placed on life cycle cost analyses since the operational, technological and environmental costs for sustaining and disposing of systems can be significant. Support concepts should satisfy user requirements for meeting and sustaining readiness thresholds and objectives, responsive transition to the support and maintenance infrastructure, and life cycle cost-effectiveness. Program Managers should consider alternative maintenance concepts in support of the operational scenario as inputs to life cycle cost analyses and design trade-offs. Acquisition planning documents should address and document compliance with the following four criteria for developing an executable support concept: Total Ownership Cost (TOC), maintenance concepts, standardization, and supportability for the life of the system. The life cycle cost (LCC) estimates should consider program objectives, operational requirements, and contract specifications for the system. A programmatic assessment using risk management techniques should be conducted in order to meet operational support requirements at the lowest total cost. The LCC estimates should also consider the degree of openness of a solution and the impacts on the total cost of ownership. An OS solution may have less development, production and O&M costs than a closed system solution. Cost As an Independent Variable (CAIV) provides a focus on TOC throughout the system life cycle and allows program managers to make logical objectives and thresholds trade-offs to reduce TOC. Appendix F provides additional information on logistics operations cost.

2.2.1.4.1 Risk Management. The beginning of a system development or major upgrade program is an opportune time for the program manager to consider risk management techniques. The PM needs to include consideration of sustainment risk drivers (e.g. sole source, outdated or fast changing technology) in the risk management plan. Further guidance is available through the Risk Management Pamphlet (JACG).

2.2.1.4.2 Manpower Estimate. The manpower estimate should identify the total number of personnel needed to operate, maintain, and support the program. It should include the number of military (officer, warrant officer, and enlisted), DoD civilian, and contract manpower requirements throughout the life cycle of the program.

2.2.2 Support the Design. Its not enough to just design a system for support, the support infrastructure also needs to support the design. Generally speaking, to effectively reduce TOC the better the support approach is defined up-front, the lower the life cycle cost will be.

2.2.2.1 Maintenance Plan. Even the best planned, budgeted and acquired asset will fail to adequately deliver unless an operations and maintenance plan is incorporated into the asset's acquisition process and properly executed. Well-defined maintenance concepts can ultimately prove less expensive than more frequent asset replacement. Operational analysis indicates when new technology can make the replacement of an asset less expensive than maintenance of the existing asset. Analyses, test and evaluation results, and program reviews should confirm the adequacy of the proposed maintenance plan and programmed support resources to meet weapon system performance objectives. Parameters used in determining support resource requirements should be traceable to program objectives and thresholds. The main objective is to improve the analysis and integration of planning considerations in the DoD systems acquisition process. The concurrent evolution of the weapon system depends on a clear statement of key user requirements to include: affordability, deployment concepts, utilization rates, and maintenance/support concepts.

2.2.2.2 Sustainment. Is dependent on a specifically tailored support concept that satisfies user needs of all support performance parameters considering the most life cycle cost-effective operational and support system. A follow-on operational testing program assesses performance and quality, compatibility, and interoperability, and identifies deficiencies as appropriate.

2.2.2.2.1 Software(S/W) /Products Sustainment. S/W has increasingly become a critical element in the development of all DoD systems. It is a critical part of aircraft flight management systems, weapon system controls, precision guidance systems, C^4I systems, satellite systems and missile systems. S/W is embedded in systems as an integral part of the system. Updating and maintaining systems is impacted by the need to update and validate changes in the S/W design. Key elements of sustaining S/W revolve around the use of a recognized methodology in the development of the S/W. The government/industry standard for S/W development is the S/W Engineering Institute's S/W Engineering Process Management Program. This program is implemented by using the S/W Capability maturity model as the guiding principles for S/W development. The level of risk in upgrading and changing S/W code is measured by the adherence to a standard methodology that allows tracing requirements from top level down to individual blocks of code. Conducting an assessment of a contractor's S/W development capability using the maturity model assessment tool facilitates the process of understanding how the code was developed and how well the contractor responded to system requirements.

2.2.3 RBL Concept. RBL affords the program manager the opportunity to take advantage of reliability improvements being generated by industry. Manufacturers,

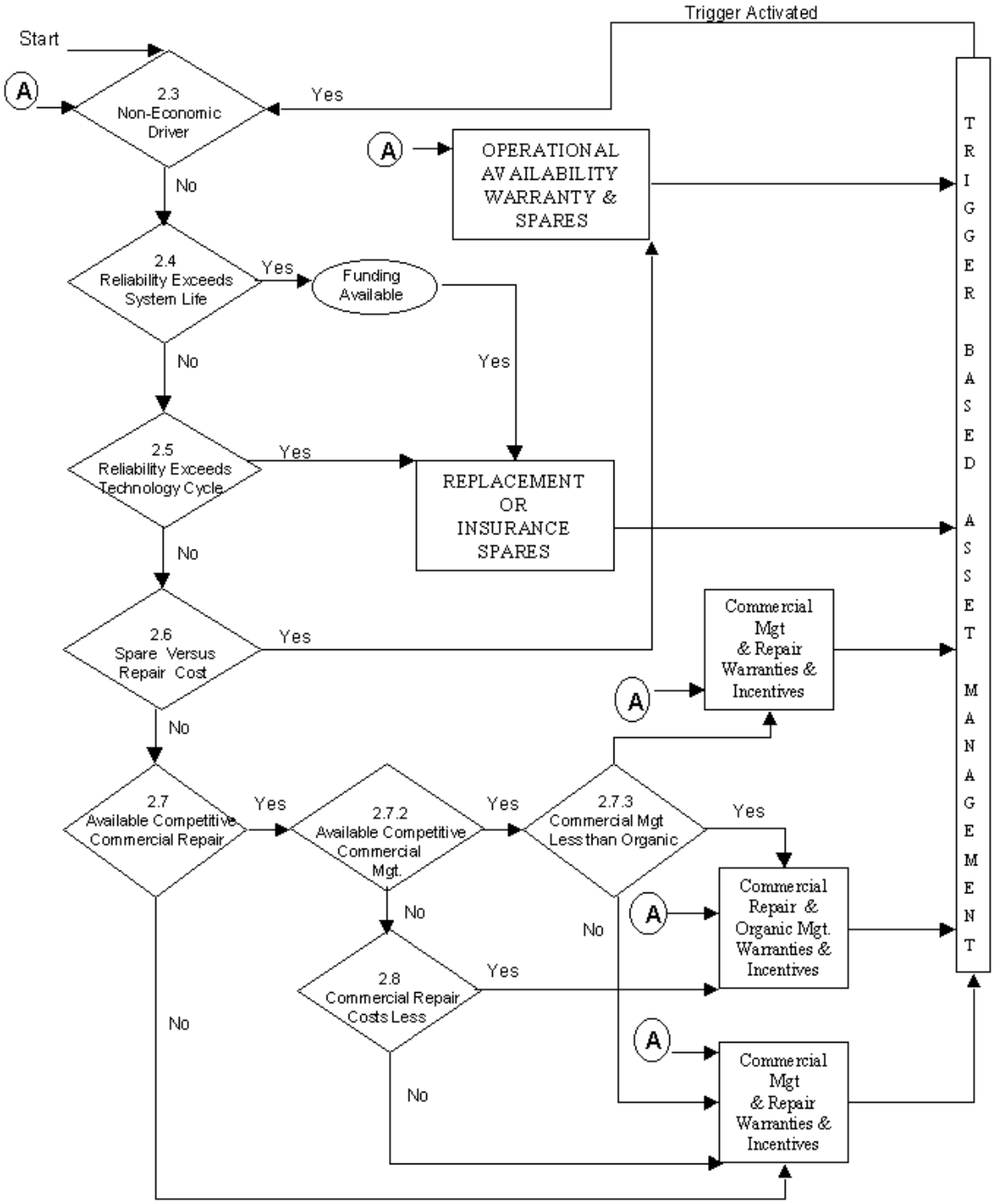
using evolving technologies, are providing new/upgraded products that are demonstrating significantly increased reliability in the operational environment. These developments may dramatically reduce the need to facilitate expensive repair capability. In addition, rapidly changing technologies lend themselves to commercial support while stable technologies may favor organic repair. When repair sources are selected, the necessity to provide sufficient pipeline spares to meet our operational needs is essential regardless of the repair location. This must be considered in organic vice commercial repair trade-off decisions to determine the most cost-effective life cycle support solution.

Rapidly changing technologies and the reduced defense budget have created the current situation where industry has overtaken DoD as the primary developer of new and emerging technologies. This further emphasizes the need for program managers, in both defense and industry, to work together with a common goal to implement new and innovative support solutions. As an example, Program Managers need to consider contracts that contain Performance-Based warranties and incentives, which can provide innovative cost-effective in-service support alternatives. Refer to Appendix E for examples of warranty and contractual techniques.

2.2.4 Reliability Based Logistics Decision Process. Figure 2 provides a structured approach to implement the RBL concept. The intent of this chart is to provide a logical decision process to determine the best support solution for systems, sub-systems, and components. It includes an increased emphasis on reliability improvements and can be used during both the acquisition and sustainment phases of a weapon system's life cycle. It addresses spare versus repair decision logic, use of warranties, insurance spares, and organic or commercial repair methodologies.

Reliability improvements of both existing and future systems and new methods of doing business have presented new cost-effective opportunities that should be considered in the support planning process. Design criteria and elements of the support system can now be analyzed through sensitivity analyses that will:

- Identify cost-effective break points where reliability can influence design goals for major systems, sub-systems, and components.
- Identify life cycle cost drivers early so that costs can be minimized while not degrading system capabilities.
- Assess the life cycle impacts on resource consumption and operational readiness to identify cost and readiness drivers that can be addressed early in the acquisition process.



Note: the specific non-economic driver will determine the applicable solution
(as indicated by an "**A" in the process flow diagram**

Figure 2. **Reliability Based Logistics Decision Process**

2.3 Non-Economic Driver. The first decision block in this decision process involves evaluation of any existing, non-economic drivers that override cost considerations in determination of the maintenance concept. These factors are evaluated with cost as a secondary consideration. Typically, such factors are a constraint, stipulation, or unique operational requirement that will determine the spare/repair decision and the corresponding maintenance concept. This determination will specify which of the four support solutions (indicated by A in Figure 2) will apply in each case.

However, in today's changing business and technology environment, analyses, which assign an economic value to the spare/repair decision, should be considered. Such action, early in a program, may lead to an entirely different support approach because it may be determined that the support posture dictated by the non-economic driver is too expensive over the expected life cycle. Non-economic factors should be continually reviewed. Appendix A describes the factors used for non-economic analyses to include:

- 10 USC 2464. Core Logistics Functions
- 10 USC 2466. Limitations on the performance of depot-level maintenance of material;
- Safety
- Constraints on the existing logistics support structure
- Special transportation factors
- Deployment mobility
- Technical feasibility of repair
- Mission success (criticality and effectiveness)
- Security--such as "Special Access Required"
- Human factors
- Policy (specific statues as listed in 1.2.2)
- Environmental considerations

2.4 Reliability Exceeds System Life. The second decision block covers the situation when the reliability of a component/sub-system exceeds the life of the host system (i.e., a radio installed in an aircraft exceeds the expected life of the aircraft). This situation usually favors a decision to use spares rather than repair, but an economic analysis should be conducted in each case to confirm that the spares decision is the most cost-effective. Refer to Figure 2, block 2.4.

2.4.1 Component/Sub-system Life. Component/Sub-system (C/S) life is a function of durable life and inventory life.

- Durable Life. Durable life is how long a C/S will keep operating in a particular application. It can be determined through established engineering processes if the operating environments are accurately known. For example, the fatigue life of a metal part can be predicted given features like loads, cycling of those loads, chemical environment and temperature. The Mean-Time-Between-Failure (MTBF) for an

electronic component can be predicted if factors such as complexity, electrical stress levels, vibration, and temperature are considered. Predictions can be validated through test and evaluation.

- Inventory Life. Inventory life is how long a C/S is able to perform and remains the best value (e.g. life cycle cost value) for performing a particular system function. For example, an electronic warfare C/S that can't meet a new threat has lost its inventory life if it can't be readily modified to meet the threat. As an example, an inertial navigation C/S dependent on a gyroscope reaches the end of its inventory life when a laser based system is built that is more accurate and less expensive. An electronic box made up of many components and circuit cards runs out of inventory life when a microcircuit with 10 times the MTBF can be purchased for half the price.

2.4.2 System Life. System life is a function of five factors:

a) The design life of the system (e.g. an airframe designed to be safe for 5000 flying hours in a specific mission/training scenario). A weapon system may be composed of several systems, each with a different system life.

b) The threat environment and how it is changing (e.g. a surveillance radar may have many more years of useable life, but it is incapable of detecting or being cost-effectively modified to detect cruise missiles).

c) National security strategy changes (e.g. a reconnaissance aircraft may be perfectly capable of performing its mission for years, but due to "fly over rights" of various countries, a satellite system may be more appropriate to meet national objectives).

d) Operating costs and the costs to implement alternatives which produce acceptable mission performance. The system's cost of ownership must be affordable in its current configuration, as well as any future configurations.

e) Business considerations to include the system's cost-effectiveness.

2.5 Reliability Exceeds Technology Cycle. The third decision block represents a component/sub-system where the design reliability exceeds the expected life of the technology of the item. When reliability exceeds the technology cycle an open systems approach should be considered as a contractual approach. The technology cycle for state-of-the-art electronics may be as short as 18 months. If the design reliability exceeds the life of the technology, the item may be planned as a remove and replace item. Investment planning for follow-on technology replacements is essential. The benefits include:

- Improved effectiveness from technology insertion
- Reduced obsolescence
- Significant cost savings in manpower and resources.

2.5.1 Technology Cycle. Technology cycles vary for a weapon system, systems, and sub-systems. Some examples of systems and their typical technology cycles are as follows:

Airframe	25 years
Engines	14 years
Avionics	6 years
Computers	1.5 years
Launch Vehicles	20 years
Satellites	7-15 years

In addition, industry is continuously incentivized to upgrade technology. Driven by an increasingly competitive global economy and market dynamics, companies are discontinuing low revenue, low leverage product lines. The result is known as Diminishing Manufacturing Sources - Material Shortages (DMSMS). This has a direct effect on the ability to extend the service life of military electronic systems and equipment. In recognition of the severity of this problem, a number of DMSMS programs have been established to gather manufacturer discontinuation data and develop one-for-one component level solutions. Appendix C provides examples of proven approaches for managing DMSMS.

2.6 Spare Versus Repair Cost. The fourth decision point is the classic spare/repair decision, but the decision logic has followed a new path to this point. Determining the most cost-effective decision to spare or repair the system (its major assemblies) or individual parts (e.g., subassemblies, circuit cards, components), is dependent on the results of repair level analyses. These analyses compare the cost to repair with the cost of sparing.

Analyses must be capable of assessing sensitivity factors that determine break points where reliability improvements can affect the design of major sub-systems and components. Sensitivity analyses can identify LCC drivers early in the design process in order to minimize LCC while not degrading system capabilities.

If analyses determine that repair is the best overall solution, proceed to block 2.7. If analyses result in a spare option, or F^3I Procurement then specifications and Performance-Based warranties and incentives should be considered to ensure that the proper level of spares are available to support the system. Appendices D and E provide examples of warranties and incentives respectively. Refer to Appendix F for additional repair level analyses techniques.

2.7 Readily Available Competitive Commercial Repair. Prior to this decision being made, a Core decision must be approved. Refer to 10 USC 2464, Core Logistics Functions. This decision block refers to in-place competitive sources capable of performing the repair. If a readily available competitive commercial repair capability exists, then commercial repair, using an F^3I approach, would most likely lead to the most cost-effective support solution. This would enable technology upgrades to be accomplished, which could mitigate follow on obsolescence problems. However, it is imperative that the government include data management oversight in all F^3I applications to ensure that interchangeability with operational systems is maintained. This will also protect the government in the event that the F^3I manufacturer defaults or withdraws from follow-on contracts.

Open systems use consensus-based (for example, SAE or IEEE) and/or widely used commercial standards for defining critical system interfaces to assure access to multiple suppliers and enable the use of commercial off the shelf products for system or subsystem components. Consequently, there will be several sources of commercial repair. Additionally, by implementing OS, incremental upgrades may be incorporated during the repair process.

2.7.1. Determining Qualifications of Commercial Sources of Repair. Considerations for determining the qualifications of potential commercial contractors must be assessed. When evaluating a potential supplier's qualifications, it is important to consider the following major factors:

- Past performance
- Engineering and product support
- Management
- Finance
- Manufacturing
- Quality

Appendix G provides guidance in determining the qualifications of commercial sources and products. In addition, the following PBBE products should be consulted:

Key Supplier Process Handbook: http://www.asc.wpafb.af.mil/az/jacg/pbbe/pbbe.htm
Performance Risk Assessment Group (PRAG) Guide:
http://www.asc.wpafb.af.mil/az/jacg/pbbe/pbbe.htm

2.7.2 Available Competitive Commercial Management. Equipment developed or used commercially which is adopted as a military system or part of a military system should be considered for total commercial management and repair. For example, a commercial computer, which is used in a system could be repaired and managed by the commercial manufacturer. By using this approach, the government buys a support

system, not just a repair capability, and avoids duplicating an existing commercial support infrastructure. The government must have contractual controls in place to ensure that the integrity of the management system is maintained in order to meet in-service operational demands.

This management system allows the contractor the flexibility to determine the scope of spares, transportation, and manpower needed (worldwide if necessary), and to ensure that the integrity of the system is maintained. This concept provides the government with a single point of contact for all logistics support requirements.

2.7.3 Commercial Management and Repair Cost Considerations. Economic analyses, described in Appendix F, compare the combined commercial repair and management costs with organic alternatives. Commercial management's ability to meet in-service operational needs, including deployment and contingency operations, must be included in the analyses. Additional elements to be considered include:

- System product management
- System product operations
- System product distribution
- Inventory spares and material support
- Technical Data
- Systems product modifications
- Ability to meet surge needs

Cost comparisons should include total support to ensure reliable and sustainable equipment to meet the technology cycle of the system being supported.

2.8 Repair Cost. The last decision block represents final economic decision analyses to be performed. These analyses compare commercial repair and organic management with the establishment of organic repair. The commercial source will be either the OEM sole source or the most competitive commercial source, depending upon the decision processes in blocks 2.7 and 2.7.2. The selected repair cost option must be based on total life cycle costs and in-service support considerations

The following additional considerations should be included in analyses:

- Commercial repair, whether competitive or sole source, should permit technology insertion and DMSMS avoidance with the least impact on in-service maintenance.

- Socio-economic factors: small business set asides, Competition In Contracting Act (CICA), depot core workload, and other statutes (see 1.2.2).

- An integrated support contract with the OEM that could include additional Commercial and Non-Developmental Items (CANDI) sub-systems. This

option can address the CANDI technology insertion and obsolescence initiatives with the least impact to the government. It is imperative that, if this option is considered, the government retains the responsibility to ensure the integrity of the system configuration and that interchangeability with other applications will be maintained.

- Contractor inventory management, such as Direct Vendor Delivery (DVD), where the contractor is responsible to provide all inventory requirements directly to the user shifts responsibility from the government to the contractor. This allows the government to have insight over the supplier rather than oversight of the supplies and operate more efficiently.

- Open Systems. The government must ensure that the selected source of repair maintains strict conformance with interface standards and is able to demonstrate this through interoperability or performance compatibility testing. The government's goal is to develop a support structure that maintains the desired configuration, performs material management, produces just-in-time spares, meets contingency requirements, maintains the technical data, and provides upgrades/improvements to enhance system availability and lower LCC.

2.9 <u>Comparing DoD with Commercial Costs.</u> Standardized procedures and techniques must be used to ensure cost comparability when considering repair/rework competition between DoD components (public/public) and between organic (DoD) sources and the private sector (public/private). There are some cost accounting differences among the Military Services and even among different locations within the same service. These variations are due to different managerial and organizational service structures. These differences must be addressed in order to "level the playing field" before workloads can be compared or competed between DoD components and private industry. (DoD Cost Comparability Handbook has additional information).

2.10 <u>Warranties.</u> Warranties can offer unique opportunities to implement innovative cost and supportability solutions. Use of warranties should be included in risk management studies. Applications for warranty considerations include:

- New and emerging technology
- CANDI
- Increasing reliability in fielded system(s)
- System complexity
- Projected system/equipment usage rates
- Reliability testing & results
- Cost Benefit Analyses
- Commercial repair
- Contractor Logistics Support (CLS)

Warranties must be bilateral agreements between government and industry. For warranties to be successful, they must offer benefits to all parties involved.

The type of contract used to acquire spare parts or repair services limits the extent to which warranties can be successfully used. Warranties are normally applied to fixed price type contracts. They are less appropriate for fixed price incentive fee (FPIF) target contracts. The cost sharing mechanism of FPIF contracts normally means that the government will incur a substantial portion of the costs associated with warranty repairs and correction of deficiencies. They should not be used in cost reimbursable contracts since the government would pay for most, if not all, of the costs associated with the warranty. In such cases, incentive or award fee provisions should be used to provide profit incentive to obtain desired contractor performance. Appendix D provides further guidance on warranties.

2.11 Incentives. In order to effectively implement incentives with industry, extending the period of contractual coverage is desirable. Predominantly, support or repair types of contracts are limited to a five-year period of performance. Long term contracts (10, 15, 20 years), dependent upon the systems technology cycle, would help incentivize commercial applications of reliability improvement type warranties. Long term contracts would enable industry to justify the up-front initial investment in parts, training, facilities, and labor to effect repair capability. This would further incentivize industry to improve the reliability of its products. In addition, this could result in stability of the industrial work force, as well as an increased emphasis on quality and operational reliability for fielded systems. This could result in a win/win scenario for both government and industry. Award Term Contract (see E.6 Long Term Relationships) is a relatively new concept evolved around performance accountability for meeting Warfighter requirements and assuring expected taxpayer savings.

The key to contract performance accountability is to have some type of incentive/penalty arrangements included in the contract that will focus management's attention on meeting the stated requirements of the contract. There may be a variety of financial and non-financial incentive / penalty concepts that could be applied fairly and equally to both the public and private sectors depending on the nature of the workload. Appendix E provides a menu of incentive options and recommendations on how they are applied.

2.12 Performance-Based Specifications Performance-Based Specifications provide the opportunity for government and industry, using the IPT process, to enter into a partnership arrangement to establish supportability parameters that can result in reduced operations and support costs. Successful implementation is dependent upon the establishment and sustainment of a robust, interactive systems engineering process. This will enable the IPT to include supportability as part of the design process and provide a comprehensive, traceable means to determine the most cost-effective support structure throughout the life cycle.

The opportunity for a contractor to update system performance through technology insertion or improved manufacturing methods is perceived to be restrictive due to the government's configuration control process. The Engineering Change Proposal (ECP) process, used to implement system improvements, has proven to be a very time-consuming, expensive, and laborious procedure. The ECP process does not limit incentives for industry to initiate cost-effective support solutions.

Currently, the incentive for a contractor to update system performance through technology insertion or improved manufacturing methods may be offset by the cost associated with government approval of all changes. By using Performance-Based Specifications, the government can manage the configuration at a higher level while delegating detail design level control to the contractor. Figure 3 illustrates how, by using the systems engineering process, requirements flow-down and verification roll-up can provide interactive assessment of the design and supportability requirements.

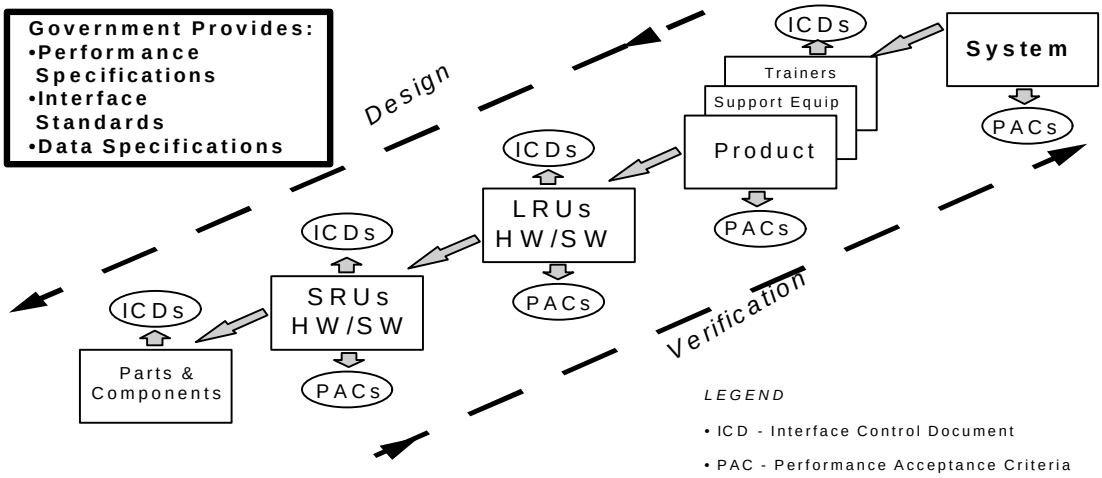


FIGURE 3. ***Design and Support Interactions***

The contractor may maintain all configuration documentation, to include SRA/SRU documentation. The government, however, must control the configuration documentation at the highest level necessary to manage risk and execute the program strategy.

A key tenet of the OS approach is to allow contractors to maintain configuration control below the repairable level established by the government. This gives the contractor maximum flexibility to make product improvements based on evolving technologies and to facilitate technology insertion without having to endure the time consuming and expensive ECP process. Detailed guidance is provided in the PBBE Performance-Based Product Definition Guide.

2.13 Flexible Sustainment (FS) Considerations. Other considerations, which may need to be addressed while using the FS process, but which are not discussed in this guide, include:

- Performance-Based Business Issues (see 1.2)
- Anti-Deficiency Act
- Competition In Contracting Act (CICA)
- Lease versus Buy Determinations
- Authority to program O&S repair funds to CLS
- Limitations on performance of depot level maintenance (see paragraph 1.2.2)
- Other ongoing logistics initiatives (e.g., value engineering, rightsourcing)

2.14 Conclusion. The techniques presented in this section can produce both short and long-term results by increasing the efficiency of the acquisition system and reducing life cycle support costs. Major considerations for the IPTs to implement RBL are as follows:

a. The acquisition system needs to be re-focused on life cycle management and Total Ownership Cost (TOC).

b. Maintenance concept decisions made early in the acquisition phases pre-determine TOC for sustainment once the system is fielded.

c. High logistics reliability is the key to flexibility; flexibility is the key to lowering TOC.

d. High logistics reliability can be realized through:

- IPT efforts to ensure reliability is designed into weapon systems
- IPT interface of design solutions and potential support concepts
- Use of performance specifications and F^3I
- Technology insertion

e. Inclusion of operational availability/system reliability warranties and complementing incentives can be powerful tools.

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SECTION 3
TRIGGER BASED ASSET MANAGEMENT

3.1 Overview. The second major process introduced with Flexible Sustainment (FS) implementation is Trigger Based Asset Management (TBAM). TBAM is a proactive approach to asset management that is based on evaluation of fielded system data and a re-examination of the maintenance support structure when "triggers", such as changes in reliability or readiness are detected. It is a follow-on process that complements Reliability Based Logistics (RBL). As discussed in Section 2, RBL can reduce life cycle costs by including reliability improvements in the systems engineering process for the initial design of a new system or upgrade of a legacy system.

A trigger is a generic term used to describe the continual evaluation of a metric (or set of metrics) that activates when the value of the metric(s) exceeds a specific deviation from an established baseline, indicating a potential issue (i.e. readiness, cost, performance, etc.) Triggers can be compared to the red light that illuminates or a warning device that sounds when the level of gasoline in an automobile gas tank drops below a pre-determined level, alerting the operator that the fuel level is low and that some action is required (specifically, fill the fuel tank). The trigger in this example is the specific pre-determined level that the fuel reaches, causing the alarm to be activated.

TBAM is a concept that enables the Integrated Program Team (IPT) to apply "triggers" as one part of the continual assessment of life cycle logistics (LCL). This is accomplished by establishing a systematic, disciplined approach through collection and analysis of fielded data during the production and sustainment phases. Teams can best accomplish implementation of TBAM, which includes both government and industry personnel. TBAM will help the IPT determine the system's Total Ownership Cost (TOC) reduction opportunities.

The IPT includes, but is not limited to; program managers, engineers, logisticians, item managers, procurement specialists, technicians, and equipment specialists. The IPT may be lead by the government or contractor, depending on the contractural arrangement (e.g., TSPR), but both should be represented. A key member of the IPT is the item manager. When triggers are activated that may affect supply levels, the item manager should coordinate with the technical members of the IPT in order to determine the most cost-effective solution. Although complete replenishment of deficit stock levels may solve the immediate problem, it may not always be the most cost-effective solution. The item manager may elect to purchase a reduced level of replenishment spares while other IPT members are performing a technical assessment of the problem. Other potential solutions, such as changes in maintenance procedures,

support equipment, or the opportunity to insert technology upgrades, should be considered by the IPT.

To some degree, DoD already has an existing TBAM system insomuch as there are triggers that cause assets to be procured or repaired to replenish stocks. The types of triggers we are used to dealing with are for the most part all related to stock level and usage rates. Trigger Based Asset Management (TBAM) applies additional metrics with their own set parameters, designed to trigger activities not solely aimed at stock replenishment, but acquiring a more in-depth look at the asset from many different aspects. The kind of indicators addressed in this chapter might not seem to have an immediate impact on the overall weapon system, but in the long term the impact will provide an opportunity for increased readiness, increased reliability, and cost avoidance's. These long-term indicators are the ones that need to be examined in a TBAM environment.

A trigger is established to identify a supportability problem that will need a timely response. An engineering resource is required that has an understanding of the system, its technology, its environment, performance requirements and configuration control restraints. Improvement possibilities would be based on known improvements in technology or manufacturing processes associated with the asset being procured. This may indicate the need for a system modification or re-engineering effort. It may also mean that an improved product can be procured relatively easily by allowing a performance-based acquisition to occur. Actions resulting from trigger activation should be based on the ability to make improvements to the asset and also on the cost-effectiveness of the improvement.

Improving the logistic support posture of an asset or system in a proactive mode should be pursued when practical and cost-effective. Information directly from the field, through existing reporting systems, i.e., Deficiency Reporting Process or verbal communications, is a vital source for validation of trigger parameters. The deficiency reporting process is the customer feedback mechanism to identify deficiencies/enhancements and provides a disciplined methodology to document and resolve the issues. The IPT should be the focal point for this effort.

3.2 Sustained Maintenance Planning (SMP). Operations and Support (O&S) costs account for 50-60% of the Life Cycle Cost (LCC) of a system. Reduced DoD funding and manpower levels further exacerbate the requirement to reduce O&S costs and redirect available funding for recapitalization and modernization programs. This must be done without adversely affecting safety or support of fielded systems.

The SMP process encompasses continual review of the established maintenance support structure to ensure that the most cost-effective, safe maintenance is being performed on weapon systems. As an element of this process, TBAM will enable the IPT to compare the actual (vice projected) reliability and maintainability of the system.

3.3 The TBAM Process. The TBAM process includes the initial development of a specific set of triggers by the IPT; the updating of each trigger based upon fielded performance of its system, the analysis findings, and the action taken in response to an activated trigger. Based on design interface and maintenance planning factors, initial trigger baseline parameters would be established. These parameters would be adjusted by the IPT based on an assessment of data obtained from the fielded system as part of the sustained maintenance planning (SMP) process. Appendix H identifies five basic categories (item cost/unit cost, reliability, maintainability, cost of ownership, and availability) with a list of potential triggers for each category. All of these categories may not be required for the system under consideration. Selection of categories should be tailored to meet the system's needs.

Identification of Triggers. Meaningful triggers for each specific system should be selected from the appropriate category. These will vary from system to system based on the complexity, criticality, application, and life cycle phase of the system. The IPT should select the initial set of triggers and establish parameters based upon the design interface and maintenance planning process. Establishing triggers on every item is obviously not feasible or cost-effective. Due to funding and manpower constraints, it is imperative that the IPT only establishes triggers that can provide a realistic potential for improvement.

Data Collection and Analyses. Timely and accurate data collection and analyses are key factors in the successful implementation of the TBAM process to reduce Total Ownership Costs (TOC). The IPT should be responsible for data collection, analyses, and adjustment of trigger parameters based on fielded performance of the system. Establishment of a SMP program best accomplishes this.

The quality of the trigger relies largely upon the clarity and credibility of the data. Management of the pertinent data (inventory levels, demand rate, reliability, maintainability, cost of acquisition, etc.) should be consolidated by the program or item manager. This data assesses inventory levels, demand rates, maintainability, reliability, cost of acquisition, cost of repair, and other pertinent parameters that could affect the LCC of the system. Appendix H identifies potential databases (selection will vary by DoD service) that can be used by the IPT to facilitate TBAM implementation. Examples of relevant TBAM data applications are described below.

a. Actual vs Design Performance. Assessment of operational reliability and maintainability performance compared to initial design (projected) parameters.

b. Demand/Usage Data. This has a relationship to reliability in most cases. Usage data can show increasing or decreasing trends for parts requirements and should be investigated for causes. An item management team needs to manage stock at predetermined levels. The word "level" is used here to encompass the entire criteria for an item because at times, there may be more involved than just stock levels. A

trigger should be established to indicate when it is time to initiate a procurement action to replenish stocks in accordance with the management stock level criteria established. A single set of criteria can be developed to cover a number of items, though specific criteria for individual assets can also be established. There are a number of automated systems in existence to assist in this process and for procurement preparation. These should be used to the maximum extent possible.

c. High Cost and High Usage. Cost and Usage can be relative terms, subject to interpretation from one situation to another, but a significant increase in either or both should be viewed as a reactive trigger requiring a review for action.

d. Significant Trends. A significant downward reliability trend, or an increase in specific complaints, may indicate an item is not meeting its intended use. An action is required to address the situation. This could be accomplished by collecting usage data, determining trends e.g. (is the asset performing better or worse than expected) and analyzing the data when a significant trend is observed.

e. DMSMS / Obsolescence. Diminishing Manufacturing Sources and Material Shortages (DMSMS) are assets that can not readily be procured. A key indicator of potential DMSMS problems can be the number of suppliers that respond to bids. For example, a major DoD contractor activates a trigger indicating a potential DMSMS problem when only three suppliers respond to a solicitation. In addition, an engineering evaluation or trade-off study may indicate that an item or system is being produced using an inefficient or unsupportable technology. See Appendix C for additional information.

One of the benefits of OS is that it facilitates DMSMS planning in a proactive manner. During the sustained maintenance planning process for new acquisitions or migration of legacy systems to OS, the systems, sub systems, or components affected by rapid technology improvement are identified. By focusing on critical interfaces and by using open standards to define those interfaces, next generation replacement parts are easily substituted. When OS are implemented, continuous market research is required for parts affected by rapid technology improvements.

OTHER PARAMETERS THAT MIGHT BE USED AS TRIGGERS.

a. Any Item With Less Life than the Aircraft. Parts inventory problems exist for the simple reason that many of the parts that go into an aircraft have a life span that is much shorter than that of the aircraft. This is an obvious first step in sorting what components should be managed with triggers.

b. Any Aircraft Availability Driver. High Mean Time To Repair (MTTR) components can be a significant driver on reduced aircraft availability. The problem can become exponentially worse when MTTR components degrade in terms of reliability.

Out of production parts impact the supply system in the worst possible manner when the item manager finds that the parts he or she is attempting to procure are out of production. The very fact that only one supplier exists for a part carried in inventory should be trigger.

Long lead times for procurement complicate parts replenishment. A component that was once easily procured can be very difficult to procure if more time is required to acquire it. Sometimes more time is needed due to a need to reverse engineer and in other cases, changes in technology result in a need for a system interface update. This type of trigger could help to avoid potential problems with suppliers.

c. Any Item With Two Or More Generations Of Technology Since The Last Update. A reliable component that has served the program well over a long period of time can suddenly become a problem when advancements in industrial technology make the component obsolete. As a result, items are no longer procurable or repairable as component parts are no longer manufactured. This advancement by industry can be monitored by simply keeping track of technology improvements as they occur. A trigger based on how often the technology changes could reduce the problems with obsolete parts.

d. Individual Parts on a Subassembly or Printed Circuit Board. Parts are a problem when they are no longer available or when other vendor's products are designed differently. This could be a trigger that identifies opportunities for reducing future risk.

e. Changes in Skill Level Requirements. Changes in skills for a system or component can result in increased returns of good components and can be a factor in maintenance induced failures. This should be a trigger that causes the item logistics management team to obtain more specialized support, training, or even test equipment. During Desert Storm, a temporary software glitch that looked like a hardware failure caused all the computers on one type of aircraft to be returned for repair. The units were found to be good and were in turn shipped back to the field.

f. Pos/Neg. Changes To Spare Levels. Any unusual change in spare levels is a trigger that could predict a trend, which may have been caused by a problem in the field that had yet to be identified.

g. Off Base Industrial Competition/Capacity. Local industry should be considered a trigger when manufacturing and repair capability is found geographically nearby. Shorter turnarounds on repairs or on delivery of manufactured components can be achieved when the factory is nearby.

h. Changes in Maintenance Burden. Fluctuations in the maintenance burden could be considered a trigger simply because of potential underlying reasons such as counterfeit parts and the need for updates to technical data.

i. Assets Requiring Unique Training. Any requirement for unique training should be considered a trigger since the asset that drives this requirement may be designed out of the system. Other approaches would be to consolidate the repairs to one or several locations to make better use of highly specialized technicians.

j. Items Needing Specialized Test Equipment. Requirements for specialized test equipment could be a trigger if a technician's capabilities were insufficient for the repair activity. This can be a precursor symptom of a larger problem involving inadequate diagnostics and/or documentation if an engineer is needed to find and fix the problem.

k. Items That Require Organizational Off-Equipment Support. Any requirement for organizational off-equipment support should be a trigger since this typically also means that there is a need for organizational off-equipment support equipment. Today's current aircraft incorporate more and more of the support equipment function in the aircraft avionics to reduce the maintenance tail. Subsystems that have a need for organizational off-equipment support would be much less of a burden on the logistics community if they were redesigned to incorporate improved diagnostics.

l. Items With Historically Poor Documentation Or Maintenance Procedures. Poor documentation or maintenance procedures would be an excellent trigger that could result in improvements that reduce maintenance-induced failures. Improvements in documentation could lessen the needs for training. Historical records of procurement problems must be maintained. This data should be retained for new procurements, replenishment procurements, or repaired items. In addition, actual cost data trends should be used to ensure the government is obtaining fair value for products and services.

m. Changes In Deployment, Environment, and Aircraft Configuration. Changes in deployment, environment, or aircraft configuration can drive increases in repair activity and part demand and therefore should be considered as triggers. If the need for increased spares results from a change in the environment (e.g. geographical location) etc., then it may be more cost-effective to redesign some components to meet those unforeseen needs.

Assessment of Selected Triggers. Assignment of too many triggers and/or establishing restrictive parameters will adversely impact the effectiveness of the TBAM process. Application of common sense by knowledgeable IPT members is paramount. When an asset is considered, all logistics aspects should be reviewed. The goal of the evaluation is to determine whether application of triggers could improve or sustain the logistic posture of the asset or its system at a reduced cost.

Ideally, trigger activation should identify a potential problem in a timely manner that would allow accomplishment of corrective action, before the situation becomes critical. Basic parameters that impact logistics presently, but especially in the long term, such as: significant changes in reliability, repair costs, demand rates, etc., should be examined. Any changes in these parameters should be re-examined to find the cause. Completion of this assessment will validate the selection of triggers for the applicable system.

3.3.1 Valid Trigger Activation. Once the initial TBAM process has been established and a trigger is activated, the first action is to validate the trigger. This is the most important step in the TBAM process. There are many possible interactions that can affect the logistic parameters being assessed. In addition, several triggers may be activated simultaneously. For example, the IPT could be assessing trigger activation indicating a negative mean-time-between-failure trend while a low stock level trigger could be under review by the item manager. It is most important that members of the system IPT establish an effective communication network.

An activated trigger needs to be examined to confirm that it was not caused by a temporary, understandable event, such as a large-scale deployment or exercise. An obvious example would have been the massive number of triggers that could have been activated during Desert Shield and Desert Storm. If the IPT member validates the trigger, the TBAM process should be continued as depicted in Figure 4.

3.3.2 Program Manager Action. When a trigger is activated, the first action to consider is notification of the responsible Program Manager(s) (PM). In some cases the PM may be in the process of correcting the cause for the activated trigger (i.e., a part is being replaced by a pending Engineering Change Proposal (ECP)). In other situations, the PM may not have been aware of the potential problem and may need to coordinate with the IPT leader or other team members as appropriate. The PM should then define the problem and take corrective action as necessary.

3.3.3 Trigger Type. This decision block distinguishes between triggers related to reliability and those related to other considerations, such as DMSMS, maintainability trends, software problems, training shortfalls, or maintenance procedures.

3.3.4 Actual versus Projected Reliability. This decision compares actual reliability versus projected reliability. If reliability trends are higher or lower than projected, the IPT, using the SMP process, should take appropriate action. If a validated trigger indicates higher than expected reliability, the IPT should consider application of RBL or other support solutions. On the other hand, if a lower than expected trend is detected, the IPT should consider solutions depicted by blocks 3.3.5 through 3.3.12.

3.3.5 DMS/MS and Non Conformance. In evaluating a non-reliability trigger, the IPT must recognize that there may be several related factors, such as training,

equipment technical data, or operational environment, which should be considered together.

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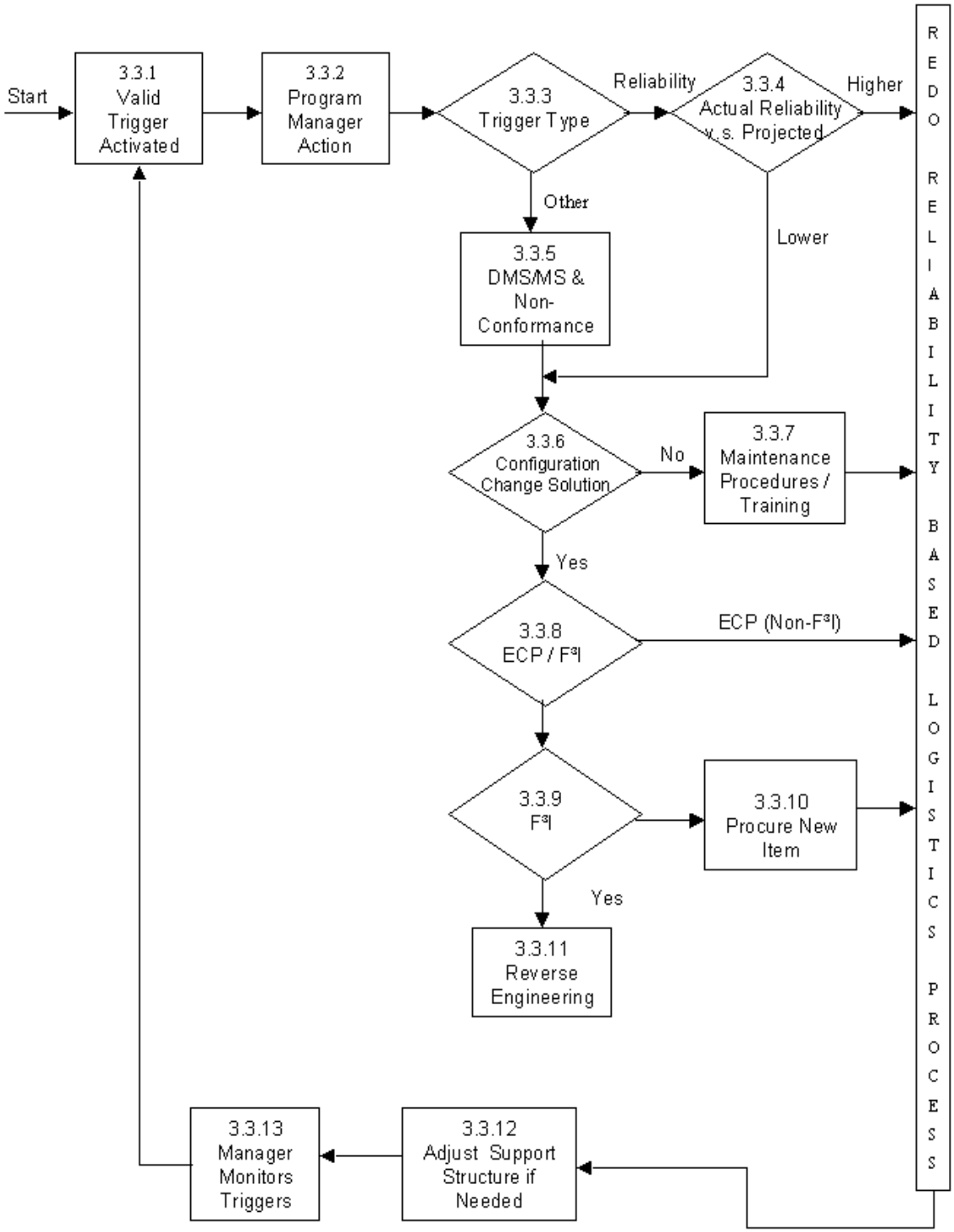

Figure 4. Trigger Based Asset Management (TBAM) Decision Process

3.3.6 Configuration Change Solution. After determining the specific nature and cause of the trigger, whether related to low reliability or other factors, the IPT must decide if the action required is a “non-configuration change” solution (i.e., no hardware or software changes). This type of solution should always be considered first since it is often the most economical and quickest solution. A change that affects the configuration of an item, either hardware or software, is a configuration change.

3.3.7 Maintenance Procedures/Training. If a non-configuration change path is selected, it must be decided if changes can be made in maintenance procedures, training, support equipment usage, technical publications, etc. The root cause could be traced to something as simple as an inaccurately described maintenance procedure to “add shims to +/- 0.003 inches” when it should be “add shims to +0.003, -0.000 inches.” Another example that necessitates a non-configuration change solution is locating and removing a quantity of defective items from the supply system. If analyses of the non-configuration change demonstrated a significant change in reliability, the Reliability Based Logistics (RBL) process should be reexamined.

3.3.8 Engineering Change Proposal (ECP). If the PM, based on the IPT recommendation, decides the solution is a configuration change, the ECP process should be initiated and the RBL process should be re-examined. It is important that we stress that if the government does not control the detail design documentation, the contractor must maintain this control. Configuration Control can be delegated to any level (subsystem, SRA/SRU, etc.) deemed appropriate by the government as documented in the contract. The government must ensure that the contractor has a disciplined change control process which ensures that changes do not affect form, fit, function, and interface. If the PM decides that F^3I is a viable option, proceed to block 3.3.10.

3.3.9 Form, Fit, Function and Interface (F^3I). F^3I presents an opportunity for the PM to obtain lower life cycle costs for the system with no degradation to in-service support. It is imperative that the PM and the IPT ensure that the government or responsible contractors maintains control of the F^3I configuration. This control includes sustainment of the data package (can be delegated to the contractor with government oversight), training and support equipment requirements, and repair procedures. The PM must ensure that if the F^3I contractor defaults or elects to discontinue production or repair, the F^3I data package is obtained to allow for future procurement or establishment of organic capability. Additional Performance-Based criteria for F^3I are contained in the Performance-Based Product Definition Guide and in Section 4 of this document.

3.3.10 Procure New Item. Once the decision is made to procure a new item many considerations must be analyzed. To implement DoDD 5000.1 and DoD 5000.2-R regarding new procurements an integrated framework is established for translating broadly stated mission needs into stable, affordable acquisition programs that meet the warfighters needs and can be sustained, given projected resource constraints. Next, a

rigorous, event oriented management process is initiated for acquiring quality products that emphasizes effective acquisition planning, improved communications with the warfighter, and aggressive risk management by both Government and Industry.

3.3.11 Reverse Engineering. The objective of applying reverse engineering technology to the problem of legacy systems is to facilitate the disciplined evolution of the system from its current state to a new (desired) state. This objective may be realized if one views reverse engineering as an engineering problem. In essence, engineering can be viewed as a problem solving activity. Problem solving involves an understanding of the problem (i.e., a clear understanding of the root causes in terms of its existing state), an understanding of the desired state, and a path (plan) to evolve from the current state to the desired state. The salient difference between engineering and reverse engineering as problem solving activities is that, with reverse engineering, a solution---the legacy system---already exists and must be considered when developing (evolving) a solution to the new problem. The legacy system imposes certain restrictions on the problem solving activity that might not otherwise exist in a completely new engineering effort. Thus, reverse engineering can be viewed as constrained problem solving.

3.3.12 Adjust Support Structure if needed: Upon completion of the trigger process careful consideration should be given to whether the support structure has changed as a result of the action taken. Support structures include total contractor support, organic and contractor mixes, interim contractor support, total organic support, or discard upon failure.

3.3.13 Manager Monitors Triggers. The TBAM process is an iterative and life cycle process for the IPT's and Program Manager(s) (PM). In some situations, the PM may not be aware of potential problems and may need to coordinate with the IPT leader or other team members as appropriate. The PM should then define potential problems and take corrective action as necessary.

3.4 Conclusion. TBAM presents the PM with viable cost-effective solutions. When the IPT properly implements the TBAM process, it can be a valuable tool in anticipating support issues in a timely manner and reducing total life cycle costs. An important factor in achievement of this objective is setting and maintaining trigger parameters and establishment of a robust IPT. Some key observations from this chapter are listed below.

- Triggers are the "technical performance parameters" in the flexible sustainment process.
- They require parallel "effectiveness measures" for the process to lead to action.
- Measures and associated tools may be service unique.
- Some of the triggers may be used in combination with others.
- Requires technical and logistics trained team to apply.

- TBAM is a continual program office function

SECTION 4
PROCUREMENT ALTERNATIVES

4.1 Introduction. The Department of Defense actively manages nearly 5 million items for consumption by the various services. These items range from the simplest of nuts and bolts to the complex avionics systems on our advanced fighter aircraft. The vast majority of these items were originally designed and procured without the benefits of now modern acquisitions techniques as described in Sections 2 and 3. Migrating the acquisition strategies for these items to these modern management techniques is a complex and costly decision process and is influenced by a multitude of factors, including lot size, technology stability, vendor base, etc. In many cases, it will remain cost-effective to continue the existing acquisition strategy. Sections 2 and 3 presented the RBL and TBAM processes as proactive techniques that should be used by the Program Manager (PM) and the Integrated Program Team (IPT) to reduce weapon system Total Ownership Cost (TOC). The basic construct of these processes is to reduce life cycle costs by including reliability improvements during the systems engineering process for initial design or system upgrade. In addition, the PM should consider the use of warranties and incentives as listed in Appendices D and E. This section introduces the application of RBL and TBAM to the spares procurement process.

During the systems engineering design process, complete data packages, including detailed Build-to-Print (BTP) product definition data, were procured to allow future procurement of these items. This assisted the supply system managers to make competitive procurement decisions. Application of Flexible Sustainment (FS) concepts enables the supply manager's role to be expanded in order to consider alternative, more cost-effective solutions. Build-to-Print procurement acquires parts that are identical to the original parts with only approved changes allowed by the Government to be incorporated into the new items. While this process is very inflexible with regards to incorporating design changes and emerging technologies, it does reduce the inherent risks involved with new/changed designs.

There are three basic methods to the procurement of spares. In addition to the normal BTP option, FS suggests that the PM consider Modified Build-to-Print (MBTP) or Form-Fit-Function-Interface (F^3I) procurements as depicted in Figure 5.

This process is activated by a demand for the item, either through a service's inventory management system or by another "trigger" as described in Section 3. Traditional item management triggers item procurement only when stock levels reach pre-established levels. At this point, any process that extends the acquisition cycle time beyond the current cycle time will meet additional challenges to ensure that adequate pipeline fill rates are met.

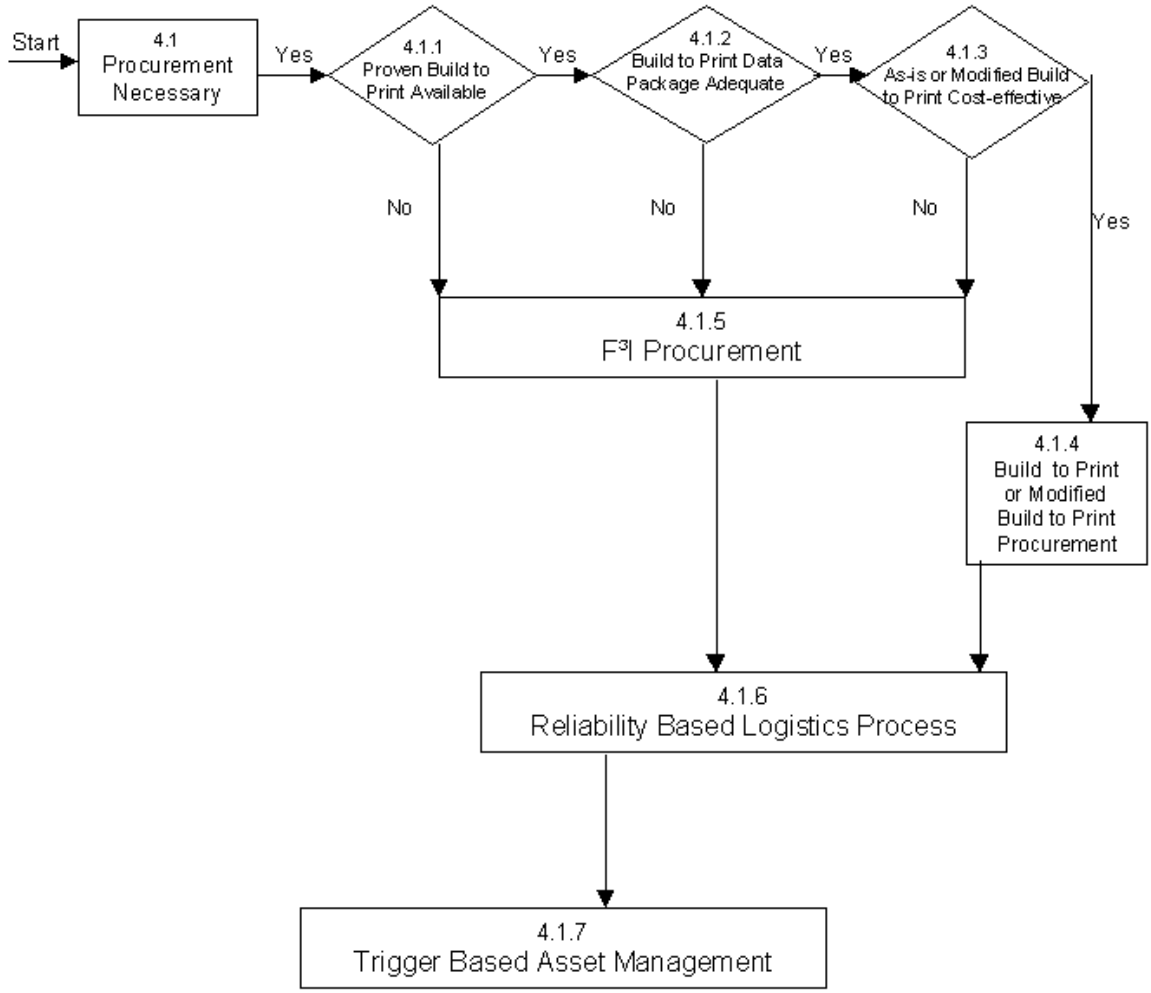

Figure 5. **Procurement Alternatives Decision Process**

4.1.1 Proven Build-to-Print (BTP) Available or Can Be Obtained. The first step is to determine if the BTP data package has been procured and is available. This decision helps determine if a BTP can be obtained. Examples of how to obtain a BTP data package include:

- Update an existing partial data package.
- Conduct market research to determine if a substitute part is available.
- Generate a new BTP data package through reverse engineering.

If a data package can be obtained, proceed to paragraph 4.1.2. If a data package cannot be obtained, the Program Manager (PM) should consider F^3I procurement (See Paragraph 4.1.5 below)

4.1.2 BTP Data Package Adequate. The next process step is to determine if the design documentation is adequate to support a competitive procurement. This is an important determination as often the BTP data package is sufficient for the Original Equipment Manufacturer (OEM) to deliver a quality product, but may not contain sufficient information necessary for another manufacturer to produce the same item. Close engineering judgement is required to assess the suitability of the design documentation. If the data package is not available, it may be obtained from the original manufacturer.

4.1.3 As-Is or Modified Build-to-Print (MBTP) Cost-effective. At this point in the process, the PM must determine the cost-effectiveness of procuring the item using the BTP or Modified BTP data packages. Analyses must also include the option of an F^3I procurement. Candidates for F^3I procurement exhibit one or more of the following attributes:

- decreasing or low reliability
- increasing sustainment cost
- high item/unit cost
- high usage item
- rapidly changing technology
- previous procurement vendor problems
- diminishing sources
- ability to insert reliability improvements
- large quantity buys
- sufficient life remaining on supported system to justify development costs
- availability of resources necessary to develop and test the replacement item

The cost to convert the BTP to a MBTP or an F^3I data package must be considered in the decision. Appendix F provides the PM with cost guidance to facilitate this decision. In addition, Appendix G provides guidance on assessing potential contractors. A full analysis of the suitability of an item to be converted to a performance based acquisition F^3I replacement may be performed using a web-based analysis tool that can be found

at http://web-tech.robins.af.mil/flexdev40/. This tool assists the PM to make the decisions based on a large set of influencing factors in addition to those listed above. The resulting recommendations from this tool provide general rules pertaining to the suitability of an F^3I procurement.

4.1.4 BTP or MBTP Procurement. When procurement using the BTP or MBTP package is determined to be the most cost-effective, the PM should initiate the procurement. BTP procurement allows no variation from the original design. MBTP procurement allows process changes, which do not degrade performance or fit, otherwise it provides a product equivalent to the original design. MBTP is used when the supplier has proven past performance and is thereby given flexibility to change manufacturing processes.

4.1.5 F^3I Procurement. F^3I is a mechanism to link design, fabrication, and support capability. It identifies all necessary operational, logistical, test, and interface requirements. This option may be available to the PM for spares procurement. Key product performance characteristics and product acceptance criteria must be specified. F^3I, especially when used with an open system approach, provides flexibility to change the design while meeting performance requirements, as well as flexibility to change the manufacturing processes to produce the design. F^3I presents an opportunity for the PM to reduce TOC with no degradation to in-service support. It is imperative that the PM ensures that the government maintains control of the F^3I configuration. This control includes sustainment of the data package, which can be delegated to the contractor with government oversight, training and support equipment requirements, and repair procedures. Additional performance-based criteria for F^3I are contained in the Performance-Based Product Definition Guide and in Appendix A.

For any item that is determined to be cost-effective to be acquired using performance based specifications, consideration for split buy should be determined. A split buy (for items that have adequate BTP documentation available) involves purchasing a certain quantity of the required lot buy using traditional BTP or MBTP processes in order to continue supply system support while the new F^3I item is developed and tested. The demand data and the expected acquisition cycle time is used to determine the quantity of split buy items necessary for continuous support.

4.1.6 Reliability Based Logistics (RBL) Process. If the F^3I, BTP, or MBTP procurement has the potential to significantly change the reliability of the item, the RBL process should be re-visited. Appendix A contains additional guidance for RBL application using the procurement process.

4.1.7 Trigger Based Asset Management (TBAM) Process. Alternative procurement options are normally activated by data elements unique to the supply system. The majority of these data elements are listed in Appendix H under the categories of availability and item cost/unit cost. These supply system data elements do not normally change enough during the replenishment process to activate a trigger. In addition, the

data elements (Appendix H) in the categories of reliability, maintainability, obsolescence, and Total Ownership Cost (TOC) are not fully integrated with the supply system database. Consequently, the PM is normally not aware of other potential in-service issues that could be activated by triggers in these categories. The ability of the PM and the IPT to effectively integrate all the categories listed in Appendix H and to tailor the relevant triggers is paramount. This is a major challenge that requires close coordination among all members of the IPT.

4.2 Conclusion. When the PM and the IPT implement the RBL and TBAM processes, they become valuable tools in anticipating procurement needs in a timely manner and at the same time provide the opportunity to reduce weapon system total ownership cost. A key factor in achievement of this objective is the ability of PM to identify, set, and maintain meaningful trigger parameters.

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APPENDIX A
NON-ECONOMIC DRIVER DETERMINATION PROCESS

A.1 PURPOSE.

Evaluate maintenance alternatives to determine the support concept based on non-economic conditions.

A.2 NON-ECONOMIC FACTORS.

Identify specific factors (i.e. constraints, policies, special requirements, human factors, etc.) which affect items. The identified factors are used in conducting non-economic evaluations, which influence the results of economic and sensitivity evaluations. Specific factors to be considered when eliminating support alternatives that are not practical or feasible, are listed below; however, this list is not all inclusive and other factors may be identified.

- Safety
- Constraints on the existing logistics support structure
- Special transportation factors
- Deployment mobility
- Technical feasibility of repair
- Mission success (criticality and effectiveness)
- Security
- Human factors
- Policy (specific statutes as listed in 1.2.2)

A.3 NON-ECONOMIC ANALYSIS.

Table 1 shows how to perform a non-economic evaluation. The method described provides a means of examining the factors which determine the maintenance level(s) where items are repaired or discarded and pre-empt an economic analysis. Provided is a logical sequence of questions concerning factors that affects the level at which repair or discard can be performed. The questions in the table should be asked of each item. The response should be “yes or no”; the maintenance level where repair or discard decisions are restricted; and reason for restriction. Then the analyst determines a preliminary maintenance concept based on the “yes” responses. All items that do not have a non-economic pre-empting factor should be evaluated using an economic analysis. All questions may not pertain to all systems under analysis and should be tailored to meet the needs of the system being analyzed. It should be noted that the repair or discard decisions should not be based solely on a non-economic evaluation.

Table A-1. Non-Economic Analysis

Non-Economic Factor	Yes	No	Maintenance Level Affected or Restricted	Reason for Restriction
Safety: Do hazardous conditions exist which preclude the item from being repaired at any specified maintenance level? Conditions to be considered include: High Voltage Radiation Temperature Extremes Chemicals or Toxic Gases Excessive Noise Explosives Excessive Weight Other: **Security:** Do security conditions exist which preclude the item from being repaired at a specific maintenance level? **Policy/Existing Maintenance Concepts:** Are there specifications, standards, or regulations pertaining to the level of maintenance at which a particular item can or cannot be repaired? This includes existing maintenance concepts or policies on similar systems to be used as a baseline for comparison.				

Table A-1. Non-Economic Analysis - Continued

Non-Economic Factor (continued)	Yes	No	Maintenance Level Affected or Restricted	Reason for Restriction
Warranties: a. Are there warranties on any item in the candidate list which restrict the maintenance level for repair or discard? b. Does the warranty eliminate organic support of an item? **Readiness/Mission Success:** Will mission readiness be compromised if any item is repaired or discarded at a specific maintenance level? **Transportation/ Transportability:** Are there any transportation factors which might preclude the transfer of systems from the user to the maintenance activity for repair? The factors include: Weight Size Volume Special handling requirements Susceptibility to damage Other **Support Equipment (SE) & Test Measurement & Diagnostic Equipment (TMDE):** a. Are special tools/TE required which would force replacement?				

Table A-1. Non-Economic Analysis - Continued

Non-Economic Factor	Yes	No	Maintenance Level Affected or Restricted	Reason for Restriction
b. Does the item require calibration? c. Do availability, mobility, size, or weight of SE and TMDE restrict the maintenance? **Packaging, Handling, and Storage (PH&S):** a. Do the item's size, weight, or volume, impose restrictions on storage? This may restrict the level where items/parts can be stocked. This would include storage of SE and TMDE. b. Are there special PH&S requirements (i.e., packaging of computer hardware/software, hazardous material, fragile material, climate control, and packaging of materials susceptible to damage during transportation)?				

Table B-1. Non-Economic Analysis - Continued

Non-Economic Factor	Yes	No	Maintenance Level Affected or Restricted	Reason for Restriction
Manpower and Personnel: a. Is there an adequate number of skilled personnel available to perform repair at a specified maintenance level? b. Would repair or discard at a level create a problem on the existing workload? **Facilities:** a. Special/unique facility requirements: Clean rooms Unique test equipment Climate control Corrosion control Forging/casting/stamping Sophisticated calibration Equipment Nuclear hardness requirements b. Special Procedures for Repair Hermetically sealed units Excessive repair times Magnetic particle inspection X-ray inspection Testing procedures: Vibration/shock analysis Wind tunnel testing Alignment procedures **Other Factors (if applicable):**				

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APPENDIX B
SYSTEM/COMPONENT RELIABILITY

B.1 OBJECTIVE.

The objective of this appendix is to provide a general understanding of reliability requirements, characteristics, terms, and calculations. There are many different books, classes, and processes that define how to determine or predict an item's reliability, so detailed explanations will not be attempted here. Especially in today's environment of acquisition reform and reliance on commercial practices, we do not wish to define any one process.

B.2 DEFINITION.

Reliability can be defined simply as the probability that a system or product will perform in a satisfactory manner for a given period of time when used under specified conditions. It is an inherent characteristic of design that begins with user requirements. According to Department of Defense (DoD) 5000.2-R: "Reliability requirements should be based on operational requirements and life cycle cost (LCC) considerations; stated in quantifiable, operational terms; measurable during developmental and operational test and evaluation; and defined for all elements of the system, including support and training equipment. They shall be derived from and directly support system readiness objectives." This policy places emphasis on meeting customer needs in an affordable manner.

The following tables identify the characteristics of Mission, Contractual, and Logistics Reliability.

B.2.1 Mission Reliability.

- Measure of system's ability to complete mission.
- Emphasizes operational readiness.
- Improved by redundancy.
- Typical terms of measurement include:
    - Mission Completion Success Probability (MCSP)
    - Mean Time Between Critical Failure (MTBCF)
    - Mean Mission Duration (MMD)
    - Launch and Flight Reliability (LFR)

B.2.2 Contractual Reliability.

- Used to define, measure and evaluate contractor's program.

- Derived from operational needs.
- Selected such that achieving them allows projected satisfaction of operational reliability.
- Expressed in inherent values.
- Account only for failure events subject to contractor control.
- Include only design and manufacturing characteristics.
- Typical Terms:
    - Mean-Time-Between-Failures (MTBF)
    - Mean-Time-Between-Critical-Failures (MTBCF)

B.2.3 Logistics Reliability.

- A measure of a system's or item's ability to operate as planned under the defined operational and support concepts using logistical resources: spares, manpower, support equipment. Typical measures include:
    - Mean time between failures (MTBF)
    - Mean time between maintenance (MTBM)
    - Mean time between demand (MTBD)
    - Mean time between removals (MTBR)

The calculation of a system's or component's reliability is dependent on the phase of development and the available data. During the development phases, the contractor will typically allocate the top-level reliability requirements down to the lower sub-system and component levels. Predictions will be provided based on component data and experience with Commercial and Non Developmental Item (CANDI). While the system is deployed, available operational failure data will provide the basis for calculations.

APPENDIX C
AN INTEGRATED APPROACH TO MANAGING AGING SYSTEMS

C.1 ABSTRACT.

Rapidly evolving technology, changing missions and declining government budgets combine to complicate the service life extension problem for equipment, systems and platforms. Faced with increasing global competition and shrinking Department of Defense (DoD) markets, companies discontinue production of older, less profitable technologies. The result is commonly referred to as; Diminishing Manufacturing Sources - Material Shortages (DMSMS). DMSMS is a highly visible problem for electronic components used in DoD equipment and systems. Reacting individually to DMSMS conditions can result in ineffective or inefficient fixes. This appendix describes an integrated approach that not only includes, but goes beyond component DMSMS to produce more comprehensive decision support information required to effectively manage a wide range of the effects of evolving technology. If an integrated approach is used, it should produce information based metrics and solution options that help asset managers create an effective road map for service life extension of electronic systems and equipment.

C.2. INTRODUCTION.

Technology is rapidly evolving. The results are numerous and dramatic. Driven by an increasingly competitive global economy and market dynamics, companies are discontinuing low revenue, low leverage product lines. One result is rapid growth in the number of older technology, low volume components no longer being produced. DMSMS has a direct effect on the ability to extend the service life of military electronic systems and equipment. In recognition of the severity of this problem, a number of DMSMS programs have been established to gather manufacturer discontinuation data and develop one-for-one solutions at the component level.

A General Accounting Office (GAO) report found "(a) DMSMS program is intended as a management tool for the early identification and resolution of situations where there is a loss, or an impending loss of manufacturers or suppliers of raw materials. The loss of item manufacturers and material suppliers can affect weapons systems during initial design, development, production and life-cycle support."

“An alternative to the reactive mode of operation is a predictive analysis in which the services try to predict which items are likely to be discontinued due to changing technology, declining demands and other causes. To the extent that the services can anticipate which items may be discontinued, they have more flexibility in designing a course of action to address DMSMS situations. To date, most of the services' DMSMS efforts have been reactive.” The GAO concluded that “Data is not collected on a DoD-wide basis concerning what the total number of DMSMS situations were, how the (DMSMS) situations were resolved, whether the most cost-effective solutions were

selected, or how DMSMS affects the capability of the forces." By combining efforts, and merging both process and data sources, DoD can create an integrated, high value-added approach to electronics management life-cycle decision support; an approach that fully addresses and answers the issues raised by the GAO.

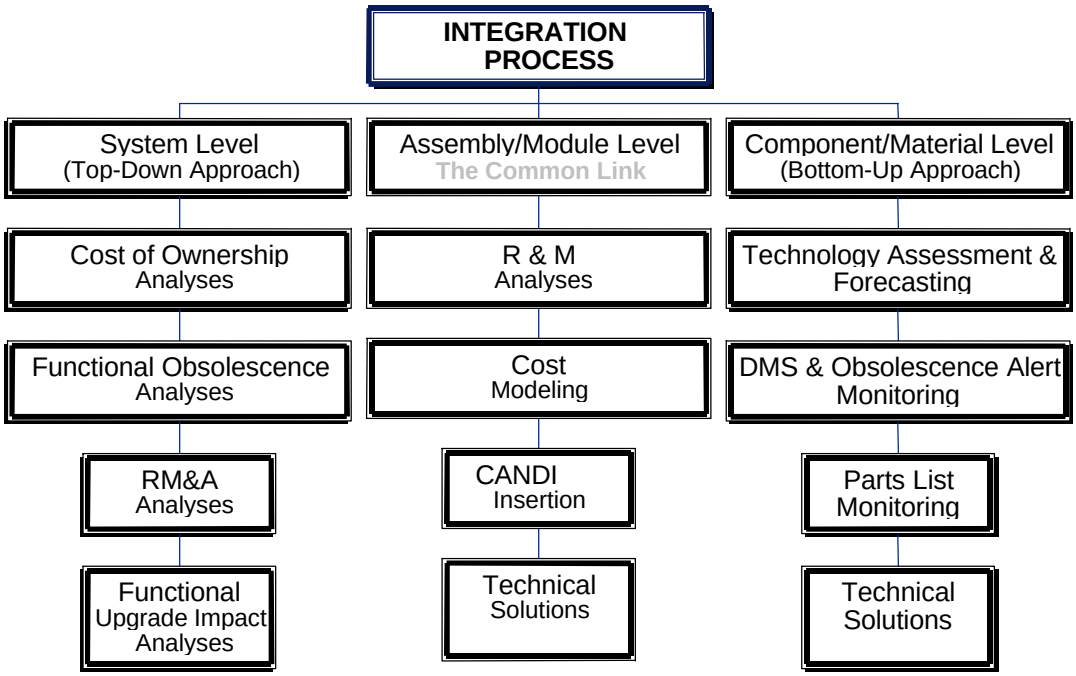

FIGURE C-1 ***Integration Process Core Capabilities***

One approach recognizes that component problems arising from manufacturers' production discontinuation create supportability problems, both during production, and in post production support. There are severe impacts that must be addressed. The question is not whether they need to be addressed, but in what priority order, and how. Clearly, resource limitations demand no less.

C.3 THE PROBLEM.

At any given point in time, demand for the products being produced no longer generates the return on the investment (human, infrastructure and capital) required to maintain a technology. The technology is then either upgraded or replaced, resulting in the discontinuation of older products. Accordingly, parts for production or repair are available only from existing inventories. If part inventories are non-existent, or

inadequate, there can be a profound effect on the ability to support the affected equipment or systems. Microprocessors are an example of component DMSMS (Figure C-2).

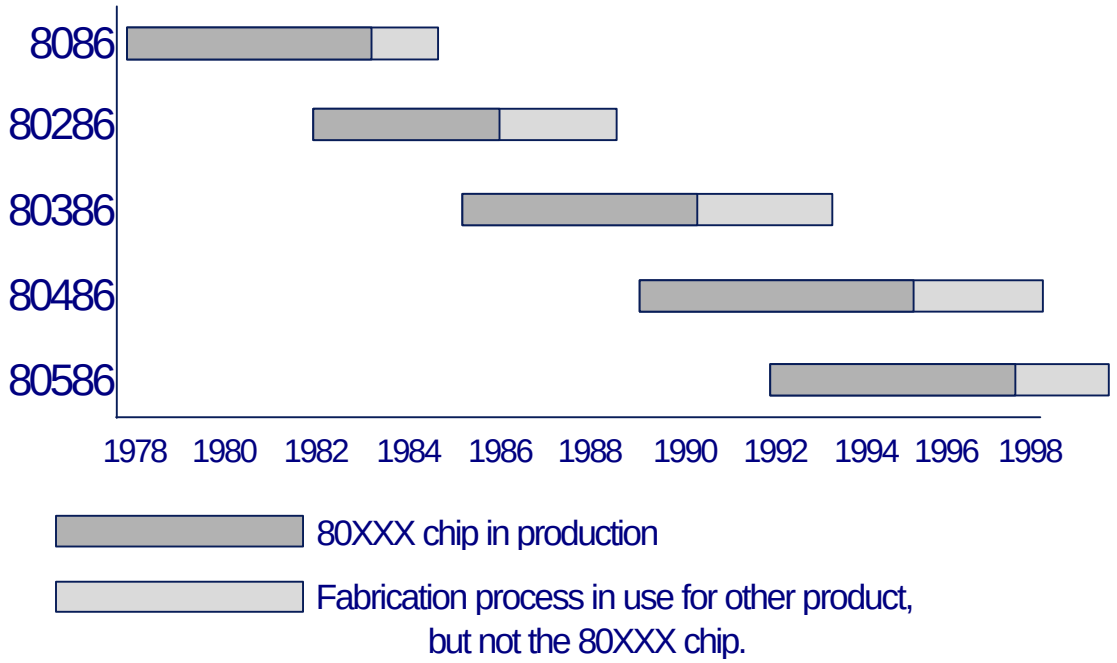

FIGURE C-2 ***Aging Technology Impact Cycle - Intel COTS Example***

The 80286, then the 80386, 80486 and so on supplanted the 8086. Newer, high performance microprocessors required the use of upgraded or new fabrication technologies and equipment. Development of new products and technology in order to produce better speed and performance is a business imperative for microprocessor manufacturers that has an impact on equipment manufacturers and users. However, there are other, equally profound effects of technological evolution, which are not directly related to component technology.

Commercial Off The Shelf (COTS) software is a readily understood example of another effect of evolving technology. Software written for one generation of microprocessors may run poorly or not at all on another generation. A software upgrade to add additional features may or may not be compatible with previous versions. The upgrade may not run at all on older discontinued microprocessors. Within, or among organizations, a software upgrade to meet the needs of one user subset may result in the need for all users to upgrade in order to maintain compatibility. However, for those using older generations of microprocessors, it may mean that hardware, which previously and otherwise meets their needs must be replaced. This functional obsolescence is a less obvious, although commonly experienced effect of evolving technology. Technology

evolution creates both piece part and functional obsolescence. In the broadest sense, obsolescence is an inability to meet requirements (the mission). In addition to the inability to build or maintain electronic systems and equipment due to component DMSMS, obsolescence can also result from a change in the environment (the threat), or reliability degradation resulting in a lack of availability, or unacceptable maintenance costs.

C.4 THE APPROACH.

To achieve cost-effective results, an integrated approach to managing a spectrum of the effects of evolving technology is necessary to meet the needs of those who manage older equipment. While case-by-case reaction to electronic component discontinuance can ameliorate an immediate problem, it may not produce either the most cost or capability effective solution. The approach to managing the effects of evolving technology needs to be based on either top down, or bottom up analysis, or a combination thereof. Mission related data, such as force structure planning, logistics, reliability and maintainability may be needed in order to produce the information necessary to create a complete plan. Component availability and technology life span prediction are required to develop accurate time phased costs and avoid less than fully effective solutions. Using the top down and bottom up approach generates decision support information at the module level.

A key aspect of the open systems approach is recognizing and planning for the component obsolescence that will invariably occur over the life of a system. In the open systems approach, the government's focus is on identifying critical system interfaces, i.e., those were the technology on either side of the interface is rapidly evolving, and selecting open standards to define these interfaces. In addition, modularity in design is a key principle of an open systems approach. Aligning functional partitioning with physical modularity facilitates modularity in design. Modularity should be used to isolate portions of the system that are dependent on technology that is likely to change, are high cost drivers, are likely to be impacted by increasing mission requirements, or are likely to evolve over the life of the system. Ideally this modularity will enable components to be replaced / upgraded without affecting other components in the system. Also, modularity is important to isolate hardware from software so that processing hardware need not be changed when software applications are modified, and so that application code need not be modified when underlying hardware is changed. For legacy systems, if the system lacks modularity, then program managers should identify a section of the system that can be isolated and modularize there. Whether derived from the component platform, system or equipment perspective, or a combination, cost and force effectiveness issues at the module level are based on answering the following questions:

- Do I have a reliability/maintainability problem that I should fix to save money?
- Even if I have a component availability problem, do I have enough spares already in place to maintain my system for its projected life?

- What is the best solution, or sequence of solutions, including upgrades, to minimize cost of ownership over the equipment or system life-cycle?
- Which components are available?
- Which components are being discontinued?
- If a component is still available, how long is it likely to remain so?
- If I have a component availability problem now, what other potential component problems should I fix so that I don't have to do this again?
- Can an open systems solution to affordably solve today's obsolescence problems and preclude or reduce future obsolescence problems be effectively implemented?

Effectiveness and efficiency result from data sharing among the processes used to produce answers to these questions. This approach is tailorable. Depending on the metrics and questions determined to be critical by each asset manager, it can be entered and exited at different points. No matter which process path is used, the result achieves the following system or equipment support objectives:

- Identification of data types and sources, and the gathering, validation and stratification of the data in order to produce technical and management information supporting the system or equipment managers concerns.
- Identification of electronic systems equipment and/or modules become technical or management problems to be addressed.
- Technical and/or management cost avoidance alternatives for electronics identified either as a current or emerging Problem.
- Implementation support for the selected solution option

DMSMS Tools and Processes can be found at the following locations:
http://www.ml.afrl.af.mil/ib/dpdsp/dmsms.htm
http://www.logtools.navsea.navy.mil/suplysup/dmsms/dmsms.htm
http://www.utcdayton.com/eng/dmsms_govt_links.htm
http://www.navsup.navy.mil/business/rsc/dmsms/dmsmslinks.html

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APPENDIX D
USE OF WARRANTIES

D.1 GENERAL. Section 847 of the National Defense Authorization Act for Fiscal Year 1998 (Public Law 105-85) repealed the requirement for contractor warranties on major weapon systems. Although weapon system warranties are no longer mandated by statute, the program manager is required to examine the value of warranties on major systems and pursue such warranties when appropriate and cost-effective.

a. The Federal Acquisition Streamlining Act of 1994 (41 U.S.C. 264 note) requires contracting officers to take advantage of commercial warranties. To the maximum extent practicable, solicitations for commercial items shall require offerors to offer the Government at least the same warranty terms, including offers of extended warranties, offered to the general public in customary commercial practice.

b. DoD5000.2-R Language revision states. "3.3.8 Warranties "The PM shall actively and thoroughly examine the value and utility of warranties on major systems and pursue such warranties where appropriate and cost-effective. When appropriate and cost-effective, the PM shall incorporate warranty requirements into major systems contracts in accordance with FAR 46.7. Warranty coverage may include guarantees on design and manufacturing, materials and workmanship, and essential performance though these types of guarantees are not mandatory. The terms of any warranty should be developed based on the objectives and circumstances of the particular acquisition and consider the planned operational, maintenance and supply concepts."

c. An additional comprehensive discussion oriented toward developing, negotiating, and implementing commercial as well as weapon system warranties can be found in *The Air Force Aeronautical System Center (ASC) Program Manager's Warranty Guide.* This guide has been placed on the ASC/SYL web page [http://www.asc.wpafb.af.mil/base/orgs/sy/syl/wty.htm]. The guide has been updated to reflect repeal of the statute that required mandatory weapon system warranties and to add information related to acquisition reform and commercial warranties.

D.2 TERMS AND CONDITIONS. Warranties are just one aspect of the contract terms and conditions. The warranty terms and conditions must be considered in conjunction with the total acquisition and are among the negotiable items. Consider and negotiate warranties in conjunction with the other aspects of the acquisition such as delivery, financing, and item pricing. This requires knowing what is "normal" practice and your "leverage" or portion of the total market in the industry in question.

a. Some statements are recommended by the FAR and DFARS for inclusion in warranty clauses. Examples are statements such as: the warranty clause shall not limit the Government's rights under an inspection clause in relation to latent defects,

fraud, or gross mistakes that amount to fraud; the warranty applies notwithstanding inspection and acceptance or other clauses or terms of the contract; and a statement that identifies redesign as a remedy available to the Government. The warranty clause should specifically state that the rights of the Government under the provisions of the warranty include no-cost Engineering Change Proposals. This is only an example of requirements that are to be included in a warranty clause and is not all-inclusive

b. FAR subpart 12.404 discusses terms and conditions of warranties for commercial items. This subpart provides-- (a) Guidance regarding tailoring of the paragraphs in the clause at 52.212-4, Contract Terms and Conditions--Commercial Items, when the paragraphs do not reflect the customary practice for a particular market; and (b) Guidance on the administration of contracts for commercial items in those areas where the terms and conditions in 52.212-4 differ substantially from those contained elsewhere in the FAR.

c. Program Managers and Contracting Officers may apply or tailor FAR Clauses 52.246-17, *Warranty of Supplies of a Non Complex Nature*; 52.246-18, *Warranty of Supplies of a Complex Nature*; or 52.246-19, *Warranty of Supplies Under Performance Specification or Design Criteria.*

d. Basically, all warranty clauses follow the same outline and many of the same terms and conditions apply for any type of warranty. To better standardize warranty clause development and facilitate the review of warranties, it is recommended that warranty clause paragraph topics follow the following format.

(1) Definitions.

(2) Duration.
. (i) Design and Manufacturing
(ii) Material and Workmanship
(iii) Essential Performance Requirements

(3) Contractor Obligations
(i) Correction of Defects (repair/replace/redesign)
(ii) Notification timing
(iii) Warranty conditions pertaining to repairs/replacements
(iv) Government Furnished Property (GFP)
(v) Labor and material costs
(vi) Transportation costs

(4) Government Obligations.
(i) Notification timing
(ii) Corrective action direction (timing)

(5) Markings

(6) Exclusions

(7) Rights and remedies

(8) Warranty reporting

D.3. SOLICITATION LANGUAGE DEVELOPMENT. Solicitation language includes the warranty clause and any Instruction to Offerors (ITO), Statement of Objectives (SOO), and Contract Data Requirements List (CDRL) requirements related to the warranty.

a. The Statement of Objectives (SOO) may include a short paragraph stating that the contractor shall manage warranties in accordance with the provisions of Section H of the contract (where the warranty clause is located). The SOO may also require the contractor to submit Failure Analysis Reports, Incurred Warranty Costs Report, Warranty Activity Report, and any other special reports designated by the program manager. The importance of addressing the warranty in the SOO is that the contractor will then be required to set up a Work Breakdown Structure for warranties and actually manage and control the warranty activities. This is especially useful if the contract includes contractor support such as ICS or CLS. It is important that the contractor's management plan be comprehensive and compatible with the warranty plan.

(1) It is important to include the elements of your basic warranty requirements (per paragraph E.2.d. above) in the draft H clause. A statement asking for the offerors' "best commercial warranty" clause leaves you with little ability to affect the basic elements of the offered warranty. However, the ITO should allow alternative warranties. Remember that warranty terms and conditions are among the negotiable items.

b. Instructions to Offerors (ITOs) may be used to require the contractor to discuss warranty management in his proposal. This approach is useful and inexpensive for very simple forms of warranties or for commercial warranties which the contractor will manage using his standard business practices. The ITO should allow contractors to propose alternative warranties that may achieve the same goal as the Government's warranty, but at a lesser cost to the Government.

D.4. WARRANTY CONSIDERATION MATRIX. Figure D.1 provides notional guidance for the selection of appropriate types of warranties. It suggests warranty types that should be considered dependent upon whether contracting for spare parts or repair services, subject to the criteria outlined in the RBL decision process. Refer to Figure D-1, for warranty types and applicable conditions for their use including the objectives to be achieved.

It is possible to combine warranty types to obtain the desired level of protection or program objective. Such combinations can reinforce each other and motivate desired contractor performance. The type of contract used to acquire the spare parts or repair services limits the extent to which warranties can be successfully used. The warranties listed here are generally limited to fixed price type contracts, especially firm fixed price (FFP). They are less useful for fixed price incentive fee (FPIF) target contracts because the cost sharing mechanism of the contract means that the government will probably incur a substantial portion of the costs associated with warranty repairs and correction of deficiencies. They should not be used in cost reimbursable contracts since the government would pay for most, if not all, of the costs associated with the warranty. In such cases, incentive or award fee provisions should be used to provide profit incentive to obtain desired contractor performance.

The attached matrices are notional guides to the selection of appropriate types of warranties. The first suggests warranty types that should be considered dependent upon whether one is contracting for spare parts or repair services, subject to the criteria outlined in the reliability based logistics decision process. At the bottom of the matrix are listed warranty types along with applicable conditions for their use and the focus, or objective, that the warranty is designed to achieve. After selecting candidate warranties, the next two matrices, Figures D-2 and D-3, can be used to select the best type based upon program objectives and equipment characteristics.

	WARRANTY TYPE																
CONDITION:	RIW	R&MIW	T&RIG	MTBF-VT	AG	LSCG	WOS	CLR	MPC	SPLW	R&MW	CRW	RW	UFG	ULW	CSLW	R&EA
Spare--Reliability exceeds system life			X	X	N/A		X	X	X	X	X	X		X	X	X	X
Spare--Reliability exceeds technology cycle			X	X	N/A		X	X	X	X	X	X		X	N/A	N/A	X
Spare--Costs less than repair	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X
Competitive Commercial Repair	X	X	X		X	X	X										X
Contract repair (costs less than organic)	X	X	X	X	X	X	X		X				X				X
Repair--Organic less									X				X				

WARRANTY LEGEND:		APPLICABLE CONDITIONS:	FOCUS:
RIW	Reliability Improvement Warranty	Units must be depot repairable	Reliability improvement; availability, readiness, MTBF
R&MIW	Reliability & Maint. Improvement Warranty	Units must be depot repairable	Reliability and maintainability improvement; availability, readiness, MTBF
T&RIG	Test & Repair Improvement Guarantee	Mission essential test equipment	Ensure test equip & procedures demonstrate MTBR & MTBF guarantees
MTBF-VT	Mean Time Between Failures-Verification Test	MTBF is appropriate reliability parameter	Achieving required field MTBF
AG	Availability Guarantee	Dormant or continuously operated systems	Ensure required operational availability achieved
LSCG	Logistics Support Costs Guarantee	Appropriate LSC model exists	Control logistics support costs
WOS	Warranty of Supplies	Critical, potentially high-failure rate items conformance	Extend KR responsibility for materials, workmanship, and spec
CLR	Chronic LRU/WRA Guarantee to repair	High cost LRU/WRAs; complex, difficult frequent failures	Identify & correct deficiencies in items having abnormally
MPC	Maximum Parts Cost Guarantee	New mission-essential complex items overhaul	Establish ceiling on materials cost per flying hour for maint., repair,
SPLW	Spare Parts Level Warranty	Stable design items	Maintain original system capability with lowered MTBR
R&MW	Reliability & Maintainability Warranty	Mission critical, high-failure rate items	Motivate production contractor to increase reliability & reduce MCMT
CRW	Component Reliability Warranty	Mission critical, high tech risk, repair, cost	KR & govt. selection of parts with guaranteed minimum level of reliability
RW	Reliability Warranty	Prime mission/safety-essential items--org maint.	Reduce failures during intervals between periodic overhauls
UFG	Utility Functions Guarantee	Consumable components	Increase reliability, durability, or other performance function
ULW	Ultimate Life Warranty	Airframe, structure, engine components, etc.	Increase reliability to reduce premature failure
CSLW	Commercial Service Life Warranty	Major systems, subsystems, structural items	Provide extended coverage for anticipated Service life
R&EA	Repair & Exchange Agreements	Not cost-effective to develop organic support	Provide rapid contractor replacement of defective equipment/components

FIGURE D-1. ***Warranty Consideration Matrix***

Program Objectives	RIW	MTBF-VT	SVG	LSCG	MPC	AG	CRG	CCR	MDG	CLR	ULG	COD	CSL
Correction of Deficiencies Conformance to Specifications Interim Contractor Support	X	X				X				X		X	
Cost Ceiling and Pro Rata Cost Coverage Logistics Support Cost Maximum Parts Cost Repair or Replace Cost				**X**	**X**								
Reliability System LRU/WRA's or SRU/SRAs Major Components	X	X								X			X
Availability and Readiness Shop Return Rate						X		X	X				
Performance Goals MTBF Lifetime of Consumable Components Lifetime of System or LRU/WRA		X					X						X
Dormant System Performance Storage Reliability Mission Goals Captive-Carry Availability			X			X		X			X		X

Legend:

AG	Availability Guarantee	LSCG	Logistics Support Cost Guarantee	SVG	Storage Verification Guarantee
CCR	Captive-Carry Reliability Guarantee	MDG	Mission Dependability Guarantee	ULG	Ultimate Life Guarantee
CRG	Component Reliability Guarantee	MPC	Maximum Parts Cost Guarantee		
CLR	Chronic LRU/WRA Guarantee	MTBF--VT	MTBF--VT Verification Test		
COD	Correction of Deficiencies	RG	Reliability guarantee		
CSL	Commercial Service Life Guarantee	RIW	Reliability Improvement Warranty		

= Include this PPA in the list of potential PPAs.
 # Exclude this PPA from the list of Potential PPAs.
+ Indicates that this PPA is potentially relevant, but not clearly so.
- Used to strongly caution the use of this PPA due to some negative impact to the stated program objectives or characteristics.

FIGURE D2. ***PPA Selection Matrix - Part 1***

	PPA												
Equipment Characteristics	RIW	MTBF-VT	SVG	LSCG	MPC	AG	CRG	CCR	MDG	CLR	ULG	COD	CSL
Equipment Module													
System													
LRU/WRAs Only													
SRU/SRAs Only													
Engines (Manned Systems)						X							
Engines (Unmanned Systems)	X	X											
New Technology													
Operation Time Characteristics													
Dormant													
Continuous Use													
Fixed Time Intervals			X			X							
Variable													
One-Shot													
Operational Lifetime													
Consumable Components													
< 3 to 5 Years (Short)			X	X									
≥ 3 to 5 Years (Long)						X		X			X		X
Length of Production Schedule													
< 3 to 5 Years (Short)						X							
≥ 3 to 5 Years (Long)													
Contract Type													
FFP													
CPFF													
CPIF	X	X		X		X							
FPIF													

Legend:

AG	Availability Guarantee	LSCG	Logistics Support Cost Guarantee	RIW	Reliability Improvement Warranty
CCR	Captive-Carry Reliability Guarantee	MDG	Mission Dependability Guarantee	SVG	Storage Verification Guarantee
CRG	Component Reliability Guarantee	MPC	Maximum Parts Cost Guarantee	ULG	Ultimate Life Guarantee
CLR	Chronic LRU/WRA Guarantee	MTBF--VT	MTBF--Verification Test		
COD	Correction of Deficiencies	RG	Reliability guarantee		
CSL	Commercial Service Life Guarantee				

= Include this PPA in the list of potential PPAs.
Exclude this PPA from the list of Potential PPAs.
+ Indicates that this PPA is potentially relevant, but not clearly so.
- Used to strongly caution the use of this PPA due to some negative impact to the stated program objectives or characteristics.

.FIGURE D-3. ***PPA Selection Matrix - Part II***

D.2 TYPES OF WARRANTIES AND PPAs.

D.2.1 Reliability Improvement Warranty (RIW).

Objective: Achieve acceptable reliability and motivate contractor to improve reliability.

Description: Contractor repairs all covered failures and may implement no-cost Engineering Change Proposals (ECPs) for reliability and maintainability (R&M) improvement.

Applicability: Units must be depot-repairable (for example, avionics at line replaceable unit/weapons replaceable assembly (LRU/WRA) or shop replaceable unit/shop replaceable assembly (SRU/SRA) level).

Measurement: Contractor performs depot maintenance for three or more years. Turnaround Time (TAT), exclusions, and Retest Okay (RTOK), if applicable, are computed periodically.

D.2.2 Reliability and Maintainability Improvement Warranty (R&MIW).

Objective: Achieve acceptable reliability and maintainability (R&M) and motivate contractor to improve.

Description: Contractor repairs all covered failures, makes design changes to improve maintainability, and may implement no-cost ECPs for R&M improvement.

Applicability: Units must be depot-repairable (for example, avionics at LRU/WRA or SRU/SRA level).

Measurement: Contractor performs depot maintenance for three to five years. TAT, exclusions, RTOKS, and maintainability values are computed using algorithms specified in the warranty clause.

D.2.3 Test and Repair Improvement Guarantee (T&RIG).

Objective: Ensure that test equipment and procedures reliably demonstrate Mean Time Between Removals (MTBR) and Mean Time Between Failures (MTBF) guarantees.

Description: XX% of units tested will demonstrate MTBR greater than XX% of MTBF guarantee.

- Chronic units exempted

- Deficient test equipment and procedures corrected within (normally) 90 days

Applicability: Test equipment for mission-essential items covered by performance specifications. Applicable to complex test equipment, limited in number, high cost, and critical to performance verification.

Measurement: Based on specified MTBR, MTBF, and others.

D.2.4 Mean Time Between Failures-Verification Test (MTBF-VT).

Objective: Provide assurance that required field MTBF level will be achieved.

Description: Contractor guarantees field MTBF. Verification testing is conducted, and results are compared with guaranteed value. Contractor must develop and implement solution if guaranteed MTBF is not achieved. Corrections may also include provision for consignment spares or downward price adjustment.

Applicability: MTBF is appropriate reliability parameter, and field measurement can be made.

Measurement: Specified in terms of measured relationship to MTBF.

D.2.4.1 RIW with MTBF-VT.

Objective: Achieve reliability growth and ensure that required field MTBF level will be achieved.

Description: Time-phased MTBF thresholds specified together with methods for assessing MTBF.

Remedies:

Engineering analysis and corrective design and production changes
No-cost consignment spares
Accelerated turnaround time (TAT)

Incentives:

Award fee
Incentive fee

Applicability: Units should be under contractor maintenance; MTBF is appropriate reliability parameter; and field measurement can be made.

Measurement: Deployment of three or more years. Measurements at regular intervals over coverage period.

D.2.4.2 R&MIW with MTBF-VT.

Objective: Achieve reliability and maintainability growth and ensure that required field MTBF will be achieved.

Description: Same as for R&MIW plus time-phased MTBF thresholds specified together with MTBF assessment methods.

Remedies:

No-cost consignment spares
Accelerated TAT
Engineering analysis and corrective design/production changes

Applicability: Same as for RIW with MTBF-VT

Measurement: Same as for RIW with MTBF-VT

D.2.5 Availability Guarantee.

Objective: Ensure that required operational availability will be achieved.

Description: Focuses on measurable population characteristics availability specified as threshold or range.

Remedies:

Contractor must correct cause of low availability
Consignment spares in interim

Applicability: Dormant systems or continuously operating systems.

Measurement: Dormant systems

Periodic checkouts
Test launches
Bit checks
Continuously operating systems

Up time/total time ratio
MTBF and mean time to repair (MTTR) measurements

D.2.6 Logistics Support Cost Guarantee.

Objective: Control logistics support cost (LSC).

Description: Contractor "bids" target LSC based on use of a model. Field parameters are measured, and the model is used to obtain measured LSCs, which are compared with target.

Remedies:

Adjust contract price based on measured versus target values
Correction of deficiency may be required

Applicability: Appropriate LSC model exists. May require special test program to obtain measured values.

Measurement: Based on operational testing focused on use of LSC model to determine compliance in terms of measured LSC. Incentives or corrective actions based on differences between measured LSC and target values.

D.2.7 Warranty of Supplies.

Objective: Extend contractor responsibility for materials, workmanship, and specification conformance.

Description: Contractor liability for materials, workmanship, and specification conformance extended into post acceptance field operations. Duration negotiable.

Remedies:

Correction of deficiencies
One-for-one exchange
Repair of deficient items
Reduction in contract price

Applicability: Fixed-price contracts for stable design items.

Measurement: Begins at acceptance. Based on performance in accordance with contract requirements.

D.2.8 Chronic LRU/WRA Guarantee.

Objective: Identify and correct deficiencies in items that are experiencing abnormally frequent failures.

Description: Chronic LRU/WRA identified as having MTBR significantly below guaranteed value. Replaced at no cost to government and subjected to quarantine testing until chronic fault is isolated and repaired. Duration of chronic LRU/WRA guarantee normally compatible with underlying MTBR or MTBF guarantees.

Applicability: Selected high-cost LRU/WRAs for which MTBR guarantees are established. Generally used on complex, difficult-to-repair items.

Measurement: Based on frequency of LRU/WRA removals (e.g., flying hours, chronological time).

D.2.9 Maximum Parts Cost Guarantee.

Objective: Establish ceiling on materials cost and flying hours for maintenance, repair, or overhaul.

Description: Government reimbursed when actual maintenance costs exceed agreed-to maximum. Guarantee begins with first use of product and extends normally for five years minimum or number of years product is in service.

Applicability: Mission-essential complex items new to service and characterized as high technical risk or high per-unit cost.

Measurement: Specified in terms of parts or materials cost-per-flying-hour for maintenance, repair, or overhaul.

D.2.10 Spare Parts-Level Warranty.

Objective: Maintain the original system capability with a lowered (LRU/WRA or SRU/SRA) MTBR.

Description: The contractor guarantees that if the system or item exceeds a - XX% envelope from a guaranteed MTBR, spare systems and items will be provided as consignment spares. If multiple tests are made

over time, adjustments may be negotiated for exceeding a + XX% envelope.

D.2.11 Reliability and Maintainability Warranty.

Objective: Motivate production contractor to increase reliability, while reducing mean corrective maintenance time (MCMT).

Description: Contract contains MTBF guarantee for specified components and maintainability clause specifying MCMT. Contract identifies remedies when MTBF or field maintainability specifications are not met.

Applicability:

Critical installed components
Potentially high-failure-rate installed components
Other mission-critical installed components

Measurement: User maintains individual time-to-failure and MCMT records for affected component.

D.2.12 Component Reliability Warranty.

Objective: Contractor and government mutually select and agree to the spare parts that should be covered under a program designed to guarantee a minimum level of reliability.

Description: Contractor and government agree on target reliability values. Government generates monthly performance report. Both parties investigate reliability deficiencies and causes and agree on corrective action.

Remedies:

Additional spares
Correction of deficiencies
Chronic units: one-for-one replacement
Redesign and no-charge retrofit kits

Applicability: Components critical to overall satisfactory operational system performance. Items of high technical risk, reparability, and cost.

Measurement: Starts at parent system delivery for specified number of years or until MTBF and MTTR targets are met.

D.2.13 Reliability Warranty.

Objective: Reduce failures during intervals between periodic overhauls.

Description: The contract contains contractor or government overhaul interval for specified components and identifies remedy required when components (on an individual or statistical basis) experience specified types of failures before next overhaul.

Applicability: Critical, potentially high-failure-rate components. Fixed-price contract.

Measurement: User must maintain individual time-to-failure records for the affected component.

D.2.14 Utility Functions Guarantee

Objective: Increase reliability, durability, or other performance features of a consumable item.

Description: A utility function or consumption index is defined.

Applicability: Consumable components.

Measurement: Level of performance achieved in a demonstration versus defined index.

D.2.15 Ultimate Life Warranty.

Objective: Increase reliability to reduce premature failure.

Description: Prorate protection against cost of failures that occur before end of warranted life period or otherwise require retirement or replacement before end of warranty.

Applicability: Airframe, structure, engine components, engine rotating parts, and landing gear.

Measurement: Specified in terms of period of time, no reporting.

D.2.16 Commercial Service Life Warranty.

Objective: Provides extended coverage for anticipated service life.

Description: After expiration of primary warranty, contractor shares in cost of materials required to correct defects or breakage of covered items.

Applicability: Major systems, subsystems, and structural components.

Measurement: Begins at expiration of primary warranty prorated on specified basis for an established period thereafter.

D.2.17 Repair and Exchange Agreements.

Objective: Provide rapid contractor replacement of defective equipment or components.

Description: Contractor establishes:

Inventory of replacement units to meet expected demand, TATs
Repair capability, including provisions for surge requirements

Buy-out of inventory at end of agreement negotiable; end-of-agreement adjustments may cover a variety of elements, such as:

Excessive usage by government
Higher than anticipated unit installations
Delays in returning defective units
Excessive contractor inventory levels

Applicability: Used where it is not cost-effective to develop organic support.

Measurement: Normally express in terms of frequency of expected repair or exchange and associated TAT.

D.2.18 Other Warranties to Consider.

D.2.18.1 Maintainability Guarantee.

Objective: Reduce Initial Time to Repair (INITTR).

Description: Contract contains:

Maximum mean time to remove and replace the end item

Maximum time to remove and replace for components of the specified end item
Limitations on special tools required
Maximum number of personnel required for each maintenance task
Technical Manuals (TM) must be accurately defined and followed during maintenance

Applicability: Critical, potentially high Mean Maintenance Time (MMT) for end items and components.

Measurement: One time.

Maintainability demonstration
Multiple tests
User maintains M=X and crew size records

D.2.18.2 Warranty of Technical Data.

Objective: Extend contractor responsibility for technical data into post acceptance time period.

Description: Contractor warrants that technical data conform to contract requirements that prevail at time of delivery. Purpose is to ensure accurate and complete data. Duration of coverage up to three years.

Remedies:

Contractor corrects or replaces data
Price or fee is adjusted
Damages up to 10% of contract price

Applicability: Fixed-price and cost-reimbursement contracts.

Measurement: Specified in terms of conformance to control data requirements.

D.2.18.3 Warranty of Technical Manuals.

Objective: Extend contractor responsibility for TM into post acceptance time period.

Description: Contractor warrants that TM conform to contract requirements that prevail at time of delivery. Includes TM updates.

Purpose is to ensure accurate and complete data. Duration of coverage is up to three years.

Remedies:

Contractor corrects or replaces technical manuals
Price is adjusted
Damages up to 10% of contract price

Applicability: Fixed-price and cost-reimbursement contracts.

Measurement: Specified in terms of conformance to contract data requirements.

D.2.18.4 LRU/WRA Software Configuration Control and Support Agreement.

Objective: Guarantee software and hardware compatibility. Correct software errors.

Description: The following will be at contractor expense:

Software and configuration control changes resulting from contractor-responsible hardware changes
Configuration control changes resulting from software error
Software and configuration control changes necessary to bring system performance to specified level

Applicability: Systems that include both hardware and software, generally in conjunction with a hardware warranty.

Measurement: Specified in terms of conformance to configuration or performance criteria.

D.2.18.5 Fault Detection, Isolation, and Repair Warranty.

Objective: Reduce mean troubleshooting time (MTT) to a guaranteed level and maintain that reduced MTT for a specified time period.

Description: Contractor guarantees that the failure modes and effects analysis (FMEA) and the equipment, software, and TMs will detect and isolate X-X% of the possible faults within a given average time.

Applicability: Fixed-price contracts for systems intended for organic support.

Measurement: Based on specified MTT, MTTR, or other similar unit of measure. Measurement begins at government acceptance.

D.2.18.6 Software Design Commitment Guarantee.

Objective: Improve software development practices. Improve software maintenance characteristics.

Description: Provide incentives to develop software that requires little or no routine maintenance, yet is easily maintained when required. Elements of design maintainability include:

Good documentation during development
Developments of superior debug and test diagnostics
Development of software that runs on different machines

Applicability: Software in early development phase.

Measurement: Delivered software products are measured against design requirements.

D.2.18.7 Quality of Training Warranty.

Objective: Ensure skill level and knowledge available in repair shops at all levels.

Description: Behavior required to troubleshoot and repair end items will be trainable tasks to a specified level of intelligence and experience:

All data required to train will be provided to government.
Contractor-provided training will use same data.
Additional training to overcome skill problems with X years will be provided at contractor expense (including training data).

Applicability: Fixed-price contracts for items intended for organic maintenance.

Measurement: The operating major command monitors the training and the MTT or MTTR.

D.2.18.8 Rewarranty of Repaired and Overhauled Equipment.

Objective: Warrants overhauled, repaired, or replacement items.

Description: Contractor-repaired or replaced spare parts provided as result of defects in design, material, or workmanship are rewarranted for remainder of warranty period or for a specific number of months (normally 12).

Applicability: Items overhauled, repaired, or furnished by contractor as a replacement for correction of defects in design, material, or workmanship, fixed-price contracts.

Measurement: Begins at acceptance of repair or replacement parts.

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APPENDIX E
USE OF INCENTIVES

E.1 BACKGROUND.

Flexible Sustainment (FS) encourages the optimization of life cycle costs (LCC) through tradeoffs accomplished during initial or follow-on acquisition. FS capitalizes on existing commercial capabilities and practices by improving contractor and government relationships, contracting vehicles, and language. Increased use of performance based incentives to encourage the contractor to meet or exceed performance goals and objectives is central to successfully accomplishing FS.

E.2 SCOPE.

This appendix provides guidance on incentive contracting and contractual techniques that should be considered and tailored to meet specific program needs. A thorough understanding of FS concepts, the nature of the product, and the qualifications of potential sources is crucial to help formulate appropriate incentive contracting strategies.

E.3 CONTRACT TYPE CONSIDERATIONS.

Among the first and most basic incentive contracting decisions is the determination of appropriate contract type. The selection of contract type must be based on sound judgment, a valid assessment of the risks in accordance with existing guidance and statutes, and inputs from other team members. The goal is to provide the contractor with the greatest incentive for efficient and economical performance consistent with equitable allocation of technical and business risks. Inputs to this decision include: prior contract performance; assessment of risks; acquisition policy; funding projections; and industry responses. Some additional factors to consider in determining the appropriate contract type and incentives, are:

a. Pricing History. Have the same or similar items been purchased before? If so, what type of contract? Cost? Fixed Price?

b. Commercial Product. Is the product or service available commercially?

c. Risk. What are the assessed levels of cost, schedule, and performance risk? Given the stage of development (product maturity) who should bear the burden of this risk?

   1. Stability of Design. Have there been a lot of changes or are significant changes foreseen? Changes increase the risk.

2. Program Phase. There usually is a relationship between program phase and program maturity and risks. Therefore, the phase has a bearing on type of contract.

d. Development. There are specific statutory and policy requirements for use of cost type contracts as the norm in development efforts.

e. Appropriateness of Incentive. Contract type should incentivize what is important. For example, award fee contracts can be used to incentivize a variety of elements ranging from technical excellence, to expedited delivery, to quality performance.

f. Suitability of contractor's accounting system for cost reimbursement contracts.

g. Program objectives, i.e., emphasis on schedule and cost versus innovation and achievement.

E.4 INCENTIVE CONTRACTS.

The Federal Acquisition Regulation (FAR) provides for three basic types of incentive contracts; Fixed Priced Incentive Fee (FPIF), Cost Plus Incentive Fee (CPIF), and Cost Plus Award Fee (CPAF). A Firm Fixed Price (FFP) contract could be used as an incentive contract in that the contractors overall profit will be determined by how well the contractor performs under the contract. The use of a particular type of incentive contract is determined more by the risks associated with contract performance and determining target costs and target fees than what is actually being incentivized. Basically, any of the defined incentive type contracts can provide for incentives in any area that the government desires to incentivize. An incentive contract works by determining the amount of fee/profit a contractor earns based upon his performance under an incentivized area (cost, technical performance, delivery). Note that incentive contracts, particularly award fee contracts, are not self-managing and are labor intensive. The organization using an award fee contract must make a commitment throughout the life of the program to dedicate talented resources to the effective construction and management of the contract.

E.5 INCENTIVIZING RELIABILITY.

A key to flexible sustainment is reliability. Therefore, contract methods need to be identified which will incentivize a contractor to maintain and increase reliability in such terms as Mean-Time-Between-Failure (MTBF) and system/item life. Form-Fit-Function-Interface (F^3I) performance specifications when used with Reliability Improvement Warranties (RIW) can provide positive benefits for both government and the contractor.

E.6 LONG-TERM RELATIONSHIPS.

Long-term contracts of ten (10) years or more are usually required in order to incentivize the contractor to develop reliability improvements, and for these improvements to be measured and evaluated during the period of the contract. Additionally, long-term contracts are necessary to justify the up-front investment by the contractor in parts, facilities, and labor. Incentives could be established in order to incentivize item reliability, cost, and any other contract element (i.e. delivery) the government wishes to incentivize.

Award Term Contract is a relatively new concept evolved around performance accountability for meeting Warfighter requirements and assuring expected taxpayer savings. The key to contract performance accountability is to have some type of incentive / penalty arrangements included in the contract that will focus management's attention on meeting the stated requirements of the contract. There may be a variety of financial and non-financial incentive / penalty concepts that could be applied fairly and equally to both the public and private sectors depending on the nature of the workload. Award Term Contracting is one such non-financial concept for performance accountability.

The Government and Contractor jointly develop contract specific Performance Areas and Associated metrics. For each performance area, metrics are developed and agreed upon in advance. At the end of the evaluation period these metrics will be used to determine the Award-Term allocation. This is a dynamic process allowing refocus from year to year. The Award-Term arrangement will continue using the yearly evaluation period during any additional years awarded under the contract. This arrangement also allows the flexibility to the government, (agreed upon by both govt. and contractor), to change the evaluation criteria year to year if required by circumstances such as threat, mission, environment, etc.

E.7 CLS TYPE CONTRACTS.

These contracts could be similar in concept to current contractor logistics support (CLS) contracts where the contractor assumes total responsibility for the system at the Line Replaceable Unit/Weapon Replaceable Assembly (LRU/WRA) level and the associated government infrastructure would be minimal. The contractor would be responsible for item management, storage, engineering, configuration control, and contracting.

Contract types to accomplish a CLS operation vary according to the conditions of a particular acquisition environment. Often the resulting contract is a mixture of contract types. Under CLS type operations a contract may contain a firm fixed price line item for management efforts of the program. This area is subject to lower risks and is therefore suitable for a firm fixed price effort. Contract line items for repair, contract for repair, and material acquisition can be set up on a labor hour or cost reimbursement basis.

These areas are subject to more risk, especially on a long term basis, and are suitable for contract methods under which the government shares a portion of the risk. A major factor in determining how much risk is associated with any of these areas is the degree to which the system and its components are mirrored in the commercial market place. The larger the commercial applications the greater the ability of the contractor to incorporate the government operation into his normal course of commercial business, thus lessening some of the risks associated with this type of contract.

E.8 CONTRACT SCOPE.

In order to obtain reliability improvements, it is necessary for the repair source to assume configuration control This type of configuration control necessitates having access and knowledge of the contractor's proprietary data and the interrelationship of various systems. Additionally, for this type of effort, it is best to have a contract that covers a significant portion of the LRU/WRA repairs for a weapon system. This ensures that the government would receive the benefits derived from economy of scale and the contractor receives sufficient business to justify the contractor's acceptance of a long term contract and the associated risks. Due to the extensive and detailed knowledge of the overall weapons system, availability of necessary technical data and establishment of the necessary vendor/subcontractor base, the OEM may be the best source to accomplish this effort.

E.9 BASIC TYPES OF INCENTIVE CONTRACTS.

E.9.1 Firm Fixed Price. A FFP contract can act as an incentive contract. The contractor can earn more profit through superior performance that lowers the contractors cost of performance. Reduced cost of performance means increased profits. Contractor risk is greatest under this type of contract, but the potential for increased profits based upon the contractor's performance are significant. The contractor is the sole determiner of how much reduced cost and increased profits can be obtained. The contract price, not cost, remains the same to the government regardless of how well or poor the contractor performs as long as the minimum requirements of the contract are met. There are some FFP CLS contracts for small fleets of aircraft that have commercial applications. The contractor receives a FFP to maintain a certain level of flying hours for the aircraft over a stated period of time. Whatever the contractor can do to maintain the contractual required flying hour rates at a lower cost results directly in increased profits to the contractor. Thus, if a contractor has configuration control over the aircraft and makes reliability improvements, which reduces the MTBF on some of the subsystems and LRU/WRAs, the contractor's profits are increased. However, without some type of contract incentive provision tied directly to the desired reliability improvements, there is no guarantee that a contractor would seek to increase his profit through reliability improvements. The contractor could also seek to maximize his profits through better repair and supply procedures and would probably make a decision on how to so maximize his profits based upon the path of greatest return and least resistance. Another problem with a fixed priced contract is the

amount of risk that a contractor must assume under this type of contract. There probably will not be a lot of contractors willing to accept this contract type on 10 to 20 year contracts, especially for military unique weapons systems.

E.9.2 Fixed Priced Incentive Fee. Another basic type of incentive contract that can be utilized is a FPIF contract that specifies a target cost, a target profit, a price ceiling, and a profit adjustment formula. When the contractor completes performance, the parties negotiate final cost, and the final price is established by applying the formula. A FPIF contract is to be used when the parties can negotiate at the outset a firm target cost, target profit, and profit adjustment formula that will provide a fair and reasonable incentive, and a ceiling that provides for the contractor to assume an appropriate share of the risk. A FPIF contract is appropriate when:

a. A FFP contract is not suitable

b. The nature of the supplies or service being acquired and other circumstances of the acquisition are such that the contractor's assumption of a degree of cost responsibility will provide a positive profit incentive for effective cost control and performance; and

c. If the contract also includes incentives on technical performance and/or delivery, and the performance requirements provide a reasonable opportunity for the incentives to have a meaningful impact on the contractor's management of the work.

The fixed price incentive contract allows the government to specifically incentivize particular areas of contract performance. Cost is a mandatory area of contract performance that must be incentivized. Additionally, the contract can have incentive provisions that would incentivize LRU/WRA reliability factors such as MTBF and overall item life. The advantage of this type of contract is that in order for the contractor to earn additional fee, his contract performance improvement areas must be centered on around what the government desires. Additionally, contractors would be more willing to accept this type of contract on a long-term basis because the government is sharing in the cost risks. However, one problem associated with this type of contract when applied on a long-term basis is that the final cost and final price are not determined until contract completion. Therefore, a contractor may not realize the full financial benefits of improvements made until 15 years after contract initiation. Some type of modification to this basic contract type would probably be necessary in order to allow a contractor to receive the benefits of fee increases based upon reliability improvements.

E.9.3 Cost Plus Incentive Fee. The CPIF contracts are another form of incentive contracts. This is a cost reimbursement contract that provides for the initially negotiated fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs. This contract type specifies a target cost, a target

fee, minimum and maximum fees, and a fee adjustment formula. After contract performance, the fee payable to the contractor is determined in accordance with the formula. A CPIF contract is appropriate for development and test programs when (i) a cost-reimbursement contract is necessary and (ii) a target cost and a fee adjustment formula can be negotiated that are likely to motivate the contractor to manage effectively. The contract may include technical performance incentives when it is highly probable that the required development of a major system is feasible and the government has established its performance objectives, at least in general terms. Since this contract type is most appropriate for development and test programs, it would seldom be used for a support and sustainment CLS effort.

E.9.4 Cost Plus Award Fee. A Cost Plus Award Fee contract is the final basic incentive contract type. This is a cost reimbursement contract that provides for a fee consisting of a base amount fixed at inception of the contract and an award pool of dollars, that the contractor may earn in whole or in part during the contract period, sufficient to provide motivation in performance areas. The intended goal of award fee is enhanced contractor performance in those areas critical to program success that are susceptible to subjective measurement and evaluation. The cost plus award fee contract is suitable for use when:

a. The work to be performed is such that it is neither feasible nor effective to devise predetermined objective incentive targets applicable to cost, technical performance, or schedule.

b. The likelihood of meeting acquisition objectives will be enhanced by using a contract that effectively motivates the contractor toward exceptional performance and provides the government with the flexibility to evaluate both actual performance and the conditions under which it was achieved.

E.9.4.1 Incentive Use Matrix.

RELIABILITY INCENTIVE			
	PROFIT	**INCENTIVE FEE**	**AWARD FEE**
MEAN TIME BETWEEN FAILURE	MAYBE	YES	NO
ITEM LIFE	MAYBE	YES	NO
RELIABILITY EFFORT	NO	NO	YES

FIGURE E-1. ***Incentive Use Matrix***

E.9.4.2 Cost Plus Award Fee Use. Cost plus award fee contracts shall provide for evaluation at stated intervals during performance, so that the contractor will periodically be informed of the quality of its performance. Partial payment of fee shall generally correspond to the evaluation periods. This allows the contractor to receive fee increases for reliability improvements at incremental periods throughout the life of the contract. Additionally, the award fee concept allows more flexibility in incentivizing reliability improvements. Furthermore, since this is a cost reimbursement contract, contractors would have fewer objections to accepting 10 to 20 year contracts with the inherent cost risks that come from projecting that far into the future.

E.10 AWARD FEE GENERAL PRINCIPLES.

The item manager and Procurement Contracting Officer (PCO) must work together to determine if an award fee is appropriate for a contemplated contract. If so, they must jointly structure a tailored award fee plan.

- An award fee can be a part of any type contract, at any stage of the product life cycle, for supplies or services. Award fee provisions may be used with other types of contracts. Do not limit award fee to "best effort" contracts. Also consider award fee for development, production, operations and maintenance (O&M), and support effort. However, per FAR 16.404-2(c)(3), the contract amount, performance period, and expected benefits must be sufficient to warrant the additional administrative effort and cost involved.

- Award fee is an important management and communication tool. Timely identification of problems, concerns, and changes to the plan are very important.

- Award fee contracts are not self-managing and are labor intensive. The organization utilizing an award fee contract must make a commitment throughout the life of the program to dedicate talented resources to the effective construction and management of the contract.

- Per FAR 16.402-4, all multiple-incentive contracts must include a cost incentive (or constraint) that operates to preclude rewarding a contractor for superior technical performance or delivery results when the cost of those results outweighs their value to the government.

E.11 CONSTRAINTS.

There are certain roadblocks created by public law and regulation that may need to be overcome in order to implement the contracting methods necessary to support flexible sustainment. Laws and regulations concerning funding constraints contract length, competitive acquisition, small business and small disadvantaged business

participation, and the mix of government versus contractor share of depot workload (50/50) may place roadblocks in the way of contracting for flexible sustainment.

E.11.1 Funding Laws.

Funding laws have become a major constraint on the way we contract. Under current funding laws money automatically cancels after a certain period of time regardless of the fact that it has been obligated to a contract and has yet to be expended. The tracking and reallocation of such funds on a large CLS type effort, which could last from 10 to 20 years, to prevent anti-deficiency violations could be a major problem. Changes in the funding laws to accommodate this type of contracting are desirable.

E.11.2 Contract Length.

Contract length can become a problem if the Service Contracting Act becomes involved. The Service Contracting Act limits contract length to five (5) years. Some CLS contracting actions have been subject to the Service Contracting Act due to the scope of the work being performed. This becomes especially true when the contractor is simply running a Contractor Operated and Maintained Base Supply (COMBS) and subcontracting out the repair work. Another problem with the Service Contracting Act is that major contractors often refuse to accept a contract subject to this Act. The best solution would be to get the Service Contracting Act repealed. This will benefit all contracting, not just contracting as proposed for flexible sustainment.

E.11.3 Competition.

The rules concerning competitive acquisitions need to be changed. While exceptions do exist supporting sole source, or other than competitive acquisitions, developing sustainment philosophies and contracting methods that dictate, through necessity, sole source contracting environments runs counter to current public laws.

E.11.4 Social Legislation

Social legislation has impacted acquisition for years. This social legislation has increased costs and administrative lead times. In particular, the Small Business and the Small Disadvantaged Business laws and regulations have given preferences to Small and Small Disadvantaged Businesses. Since by necessity contracting methods to support the concepts proposed above would dictate sole source contracting to large OEMs, the Small and Small Disadvantaged Business goals set by government contracting would be severely impacted. Congress and small business special interest groups would have to be convinced that a share of the government procurement dollars would still be channeled to Small and Small Disadvantaged Businesses through subcontracting goals placed upon the prime contractor.

APPENDIX F
LOGISTICS OPERATIONS COST

F.1 EVOLVING MAINTENANCE PLANNING ENVIRONMENT

Traditional maintenance planning involves conducting a series of analyses during design, primarily during Engineering and Manufacturing Development (EMD), to determine the most cost-effective approaches for trouble shooting and repair of individual systems, subsystems and components. During the design process supportability analyses are completed on all repairable items to determine the optimal repair process. Tools such as Reliability Centered Maintenance (RCM) and reparability analyses are used to assist in those determinations. Traditionally those tools have been used to evaluate the ultimate source of repair given a two or three level maintenance process with organic repair usually representing the preferred solution. Once a maintenance solution is “locked in” during the acquisition process it typically remains in place for the life of the system.

Recent budgetary pressures have led to the re-examination of many maintenance decisions. Given the increasingly limited Operations and Maintenance budget, in-service systems must be maintained in an increasingly cost-effective manner in order to maximize the usage of spares assets and repair dollars. Traditional repair decisions are being challenged by such concepts as “power by the hour” for engine maintenance, innovative warranties, commercial versus organic repair decisions and a variety of phased maintenance concepts. Each of these innovative approaches requires development of cost/benefit analyses that need to go beyond the information and cost structures used for traditional level of repair decisions. This type of analyses needs to be applied for both new and in-service systems.

F.2 COST DRIVERS IN THE CURRENT ENVIRONMENT

Many of the “canned models” currently used for estimating the impact of maintenance decisions may not accurately reflect some of the major drivers that are influencing many of our maintenance policies. Some of these new concerns include:

a. More accurate assessment of the “true cost” of military personnel to accurately reflect the indirect costs associated with military manpower;

b. Evaluation of hidden “infrastructure” costs that have traditionally been ignored when making cost/benefit decisions;

c. New sparing concepts including “readiness based sparing” instead of traditional demand based sparing;

d. Impacts of commonality across weapon systems and platforms that can lead to revised maintenance approaches;

e. More aggressive use of warranties and creative teaming with industry to ensure optimal maintenance and support solutions;

f. Opportunities for technology insertion to aggressively reduce costs of maintaining current maintenance "bad actor" systems.

In order to effectively evaluate these innovative solutions, a "total cost" assessment must be made for each type of maintenance study. This type of approach involves examining elements of cost that have traditionally been ignored for many maintenance level and repair decisions. It also involves taking a rigorous look at implementation schedules, remaining service life, usage and deployment information and implementation costs to ensure that changes to current practices will be cost-effective.

Today's budget constraints are forcing Department of Defense (DoD) components to reexamine the way they conduct business. O&S costs represent a significant portion of naval aviation's Total Obligation Authority (TOA) and have been targeted for reduction in funding for modernization and re-capitalization efforts. Numerous studies have been prepared on alternative maintenance concepts that reduce O&S costs and many more innovative proposals are under review. The Maintenance Trade Cost Guidebook has been prepared by the NAVAIR Cost Department (AIR-4.2.5) to assist in the preparation and evaluation of cost analyses of alternative maintenance concepts to reduce naval aviation operating and support (O&S) costs. The objective of this guide is to assist in identification of the appropriate cost elements to consider, the best sources of critical data, and potential cost estimating methodologies.

This version of the guidebook dated 31 October 1998 supplants the previous version dated 23 June 1998. Incorporated into this version is the NAVAIR/DLA preferred guidance for conducting Direct Vendor Delivery (DVD) business case analyses (BCAs). The main objective of DVD is to reduce O & S and logistics costs by shifting maintenance responsibilities, where appropriate, from the government to the private sector. The recommended data sources and guidelines for DVD cost analyses included in this version were developed through a cooperative effort between NAVAIR, NAVICP Philadelphia, and the DLA. The Maintenance Trade Cost Guidebook can be found at: http://www.navair.navy.mil/air40/air42/Overview/reference/reference.html

F.3 COST ESTIMATING STRUCTURES FOR MAINTENANCE PLANNING

Cost structures traditionally used for maintenance planning draw heavily on MIL-STD 881B (Cost Work Breakdown Structures) and the OSD Cost Analysis Improvement Group's Operations and Support Cost Guide. Because of the relatively fixed nature of

many models currently used for cost analysis of logistics operational cost not all-relevant elements of cost may be analyzed. In the current dynamic environment a full range of commercial and organic options are available as potential maintenance concepts for both new and in-service equipment. Although the range of potential options is extensive, most alternatives can be summarized as some version of the following approaches;

a. Two level organic maintenance;

b. Three level organic maintenance;

c. Organic level removal and fault isolation with commercial repair of failed components;

d. Organic level removal with commercial fault isolation and repair of failed components;

e. Complete commercial repair in a Contractor Logistics Support (CLS) environment.

Figure F-1 provides an example of a potential structure to be used for various types of logistics operations and maintenance decisions. It identifies the potential differences in cost drivers for each type of analysis as well as the key acquisition logistics and operations and support cost elements that need to be addressed for a comprehensive analysis.

F.4 REQUIREMENTS/COST ESTIMATING DATA SOURCES

A significant problem for many current logistics operations cost studies involves the source of the basic data used to conduct the analysis. Many existing models either provide primarily accounting structures or relatively rigid Cost Estimating Relationships (CERs) or “default” values for many types of information. Given the changing nature of the maintenance environment, relying upon these types of often “outdated” information will often lead to erroneous conclusions. For each service there is a need to use the detailed maintenance history information that is available from several sources when developing logistics operations cost studies. The types of sources that should be used include:

- Spares: Supply system and stock fund accounting information needs careful screening to ensure current economy costs

- O&S Costs: Tri-service Visibility and Management of Operations and Support Cost (VAMOSC) Databases including databases addressing

both platform level and maintenance subsystem cost and usage information

- Maintenance data: Each service maintains detailed information on detailed usage and maintenance history

- Management Decision Tools: The services are developing new information systems to better evaluate maintenance and operations information

F.5 COST ESTIMATING GROUND RULES FOR LOGISTICS SUPPORT STUDIES

One of the most important requirements for accurate and reasonable cost estimating studies involves establishment of appropriate and consistent cost estimating ground rules. Factors such as the inflation guidance to be used, operating assumptions for the systems being costed, duration of life cycle, attrition rates, implementation schedules, etc. must be provided by government program managers to ensure reasonable results. Providing limited guidance to logistics evaluators in such critical areas will lead to studies with questionable or misleading results. In order for any cost study to be useful, basic assumptions, including identification of a sound technical baseline, must be completed before the “number crunching” begins. This requirement means that program technical and logistics personnel must take a proactive interest in logistics operations cost studies for them to be meaningful and useful. The program should provide certain types of information to all estimators. Along with the information identified in this paragraph, Figure F-1 provides typical logistics cost elements that should be developed.

F.6 CONCLUSIONS FOR LOGISTICS OPERATIONS COST ESTIMATING

As a discipline logistics operations cost estimating and analysis deserves the type of attention paid to end item cost estimating. For major acquisition programs acquisition costs are almost never estimated using canned models and estimating approaches. Instead they are based on detailed assessment of the technical requirements and development of estimating relationships tailored for the specific system under development. Similar discipline must be applied to logistics cost estimating if the results are to be useful and credible for decision-makers.

Acquisition

Non-Recurring Design (ECPs only)
Production (ECPs only)
Installation (ECPs only)
Maintenance Planning
Supply Support, i.e., Spares
Support Equipment
Hardware
Software
Technical Data
Technical Manuals
Training
Courses
Hardware
Facilities
PHS&T

O&S Organic

"O" Level Labor, i.e., MH/Personnel
"I" Level Labor, i.e., MH
Direct Personnel
"I" Level Personnel
Indirect Personnel
"O" Level Consumables
"I' Level
Organic Depot Component Repair
Commercial Depot Repair
Transportation
Repair
Replacement
CLS Surcharge
Contractor Management
Recurring Training Requirement
Technical Manual Updates
Support Equipment Maintenance
Test Program Set Upgrades
Infrastructure
Engineering Support
Gov't Management Support
Recurring Facilities
Disposal Cost

FIGURE F-1. ***TYPICAL LOGISTICS COST ELEMENTS***

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APPENDIX G
ASSESSING POTENTIAL SOURCE/PRODUCT QUALIFICATIONS

G.1 SCOPE.

This appendix provides guidance in assessing both the strength/weakness of potential contractors and the suitability of commercial/military products. Market research, benchmarking, and supplier evaluations can help to quantify the risk associated with procurement of a component or a whole weapons system. Emphasis on Flexible Sustainment (FS) principles is the primary focus. During these activities, understanding FS concepts, the nature of the product, industry pace setters in the specific technology, specific product characteristics and functionality, and qualifications of potential sources are crucial. Using this guidance will help answer key acquisition strategy questions and should result in making informed decisions (Refer to the Joint Aeronautical Commanders Group (JACG) Performance Risk Assessment Group (PRAG) Desk Guide for additional information).

G.2 PERFORMING MARKET RESEARCH.

Market research and analysis performed by the management/logistics/technical team will help determine the suitability and availability of required items prior to the commencement of any acquisition, development, modification, or repair effort. This understanding will enhance the development of an appropriate acquisition strategy and help choose a product that matches requirements.

G.3 MARKET SURVEY.

Market survey is an ongoing effort, which attempts to assess company capability and commercial and DoD product developments so that the procuring agency can pick the best supplier and the best price. This may include written or telephone contacts with knowledgeable federal and non-federal experts regarding requirements and vendor/product capabilities. In addition it might include the results of sources-sought announcements in pertinent publications (e.g., technical/scientific journals, or the Commerce Business Daily), or solicitations for information or planning purposes.

G.3.1 Established Market Acceptability. To have established market acceptability means that a product has been successfully marketed in substantial quantities to either the private sector or the government.

- Prototypes, models, or experimental production-runs generally do not qualify.
- It may be appropriate for some items to make provision for products currently in production, without sales history, that are slightly modified or improved versions of items previously sold.

- It is just as important to establish how well a product meets program performance (e.g. real time) requirements as it is to assess if it could have market acceptance.

G.3.2 Literature Search. One of the first steps in performing a market survey is a literature search. Review industry trade journals and brochures and government information. Documentation from the Society of Automotive Engineers (SAE), the Institute of Electric and Electronic Engineers (IEEE), and other organizations as well as attendance at pertinent technology conferences and meetings will aid in understanding potential technologies, available products, commercial standards, companies, and product markets.

G.3.3 Commerce Business Daily (CBD) Synopsis. Publish a CBD Synopsis detailing the upcoming acquisition. This makes interested companies aware of the acquisition so that they can respond and make the government aware of their interest in competing for the acquisition.

G.3.4 Industry/Government Meetings. On large procurements and procurements where the government is trying to perform acquisition differently from the past, it is helpful to host industry/government meetings. These meetings would address the major points of the acquisition such as government requirements, acquisition strategies, and maintenance concepts, and would jointly begin developing Request for Proposal (RFP) language.

G.3.5 Requests for Information. Issuing requests for information allows the potential bidders to respond in their own format with company proprietary information. This also allows the companies to voice their concerns and preferred approach or alternative.

G.3.6 Draft RFP. The first time the entire solicitation package is brought together is normally in a draft RFP. Issuing the draft RFP is probably the most important step, since this allows bidders to make comments and provide valuable feedback as to the adequacy and overall completeness of the package.

G.4 ASSESSING POTENTIAL SOURCES.

G.4.1 Benchmarking. Benchmarking is a method of measuring how well a product will meet a set of requirements. Simulation and analysis tools can be used to assess a process or a product capability. Often, the only way of assessing how a particular product will meet program requirements will be with computer simulation and modeling.

APPENDIX H
TRIGGER SOURCES

The following list provides a resource of triggers that may be appropriate for managing a particular system or commodity.

FLEXIBLE SUSTAINMENT TRIGGERS & DATA SYSTEMS

TRIGGERS	SYSTEM SOURCES				
	ARMY	NAVY	MARINES	AF	DLA
ITEM COST/UNIT COST					
COMMERCIAL SOR/SOS	FLIS	NAVSUP PARTS MASTER	NAVSUP PARTS MASTER	FLIS	SAMMS
CONTRACTOR DELINQUENCY				ADIS	SAMMS
TERMINATION FOR DEFAULT				ADIS	
MERGERS					
BANKRUPTCIES					
SINGLE SOURCE/DMS					SAMMS
NO BID		KT		ADIS	
RELIABILITY					
WEAPON SYSTEM RELIABILITY	LIDB	NALDA RMPR LMDSS	NALDA RMPR LMDSS	REMIS	
MEAN TIME BETWEEN DOWNING EVENTS	LIDB	NALDA LMDSS	NALDA LMDSS	REMIS	
MEAN TIME BETWEEN MAINTENANCE ACTIONS	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MEAN TIME BETWEEN UNSCHEDULED ACTIONS	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
FAILURE RATE	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MEAN MAINTENANCE TIME	LSAR	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
MEAN TIME TO REPAIR	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MEAN TIME BETWEEN CRITICAL FAILURE	LSAR LIDB	NALDA LMDSS	NALDA LMDSS	CAMS, REMIS	
MEAN TIME BETWEEN FAILURES	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MFHBF	LIDB	NALDA LMDSS	NALDA LMDSS	CAMS, REMIS	

ABORT RATE	LIDB	NALDA LMDSS	NALDA LMDSS	CAMS, REMIS	GO54
MTB DEMANDS	CCSS	NALDA LMDSS	NALDA LMDSS	RISC	
MC RATE	DA FORM 1352	NALDA LMDSS	NALDA LMDSS	REMIS	
SORTIE RATE	LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
CONDEMNATION RATE	WOLF	NALDA LSAR LMDSS	NALDA LSAR LMDSS	RISC	
DEFICIENCY REPORT	DRS	NAMDRP	NAMDRP	ASE	ASE SAMMS
BREAK RATE	N/A	NALDA LSAR	NALDA LSAR	CAMS	
MAINTAINABILITY					
MEAN CORRECTIVE TIME	LSAR	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
DIRECT MAINTENANCE MAN-HR PER MAINT ACTION	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
MAN-HRS PER OPERATING HOUR	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MAN-HRS PER OPERATING HOURS -- UNSCHEDULED	LSAR LIDB	NALDS LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MEAN DOWN TIME	DA FORM 1352	NALDA LSAR	NALDA LSAR	REMIS	
MEAN TIME BETWEEN REMOVAL	LSAR LIDB	NALDA LSAR	NALDA LSAR	REMIS	
MEAN CORRECTIVE MAINTENANCE TIME	LSAR	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
PERCENT CORRECT DETECTION	LSAR	NALDA LSAR	NALDA LSAR	CAMS, REMIS	
FAULT DETECTION %	LSAR	NALDA LSAR	NALDA LSAR	CAMS, REMIS	
AVG DAYS IN REPAIR	LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	RISC	
AVG DAYS AWP		NALDA LSAR LMDSS	NALDA LSAR LMDSS	DMMIS	
% BASE REPAIR	LSAR LIDB	NALDA LSAR	NALDA LSAR	RISC	
INTERMEDIATE MAINT MAN-HR/FLT HR	LSAR WOLF	NALDA LSAR	NALDA LSAR	CAMS, REMIS	

		LMDSS	LMDSS		
ORGANIZATIONAL MAINT MAN-HR/FLT HR	LSAR LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
DEMAND RATE	CCSS LSAR	NALDA LSAR	NALDA LSAR	RISC	SAMMS
DEPOT MAINTENANCE TURN-AROUND TIME		NALDA LSAR LMDSS	NALDA LSAR LMDSS	RISC	
TOTAL MAN-HOURS DEPOT DIRECT LABOR HOURS		NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
MMH/FLT HOUR	LSAR LIDB	NALDA LSAR	NALDA LSAR	REMIS	
MMH/AVAIL (OPS) HR	LIDB	NALDA LSAR LMDSS	NALDA LSAR LMDSS	CAMS, REMIS	
12 HOUR FIX RATE	LIDB	NALDA LMDSS	NALDA LMDSS	CAMS	
CND/RTOK/A-799 RATE		NALDA LMDSS	NALDA LMDSS	REMIS	
NOT MISSION CAPABLE MAINTENANCE	DA FORM 1352	NALDA LSAR LMDSS	NALDA LSAR LMDSS	REMIS	
BROAD ARROWS (PROBLEM REPORTS)	FIELD CALLS	NALDA LMDSS	NALDA LMDSS	CAMS, REMIS	
COST OF OWNERSHIP					
DLR	MCRC	MCRC	MCRC		
CONSUMABLE	STAMMIS	VAMOSC	VAMOSC	MRPM	
DEPOT MAINT		MCRC	MCRC	MRPM	
SUSTAIN ENG				MRPM	
SOFTWARE MAINT.				MRPM	
ICS/CLS				MRPM	
REPAIR PARTS COSTS	CCSS	VAMOSC	VAMOSC	MRPM	
MAINTENANCE COSTS		VAMOSC	VAMOSC	MRPM	
% REPAIR FUNDING				MRPM	
COST/FLT HOUR	CCSS	NAVSUP	NAVSUP	WMER	
AVAILABILITY					
LOGISTICS RESPONSE TIME	LIDB CCSS	NALDA LSAR	NALDA LSAR		LIPS
ISSUE EFFECTIVENESS RATE	CCSS			WMER	
PRODUCTION LEAD TIME	NSNMDR			RISC	SAMMS
ADMIN LEAD TIME	NSNMDR			RISC	SAMMS
# OF SUPPLIERS		NAVSUP	NAVSUP		
MISSION NON-AVAILABILITY	DA FORM 1352	NALDA	NALDA	REMIS	
AIRCRAFT UTILIZATION (UTE) RATE	LIDB			REMIS	
SYSTEM UTE RATE	LIDB			RAMP	
ORDER SHIP TIME	STAMMIS	NAVSUP	NAVSUP	SSSCD	SAMMS
BACKORDERS	CCSS	NAVSUP	NAVSUP		SAMMS

AVG BACKORDER AGE	CCSS	NAVSUP	NAVSUP	WRRS	SAMMS
“G” CONDITION UNITS		NAVSUP	NAVSUP		
“G” CONDITION DRIVERS		NAVSUP	NAVSUP	MRPM	
ACQUISITION LEAD TIME	NSNMDR	NAVSUP	NAVSUP	MRPM	
AVCAL NET EFFECTIVENESS		NAVICP	NAVICP		
STOCKAGE EFFECTIVENESS	S^4	NAVSUP	NAVSUP		SAMMS
MICAP AVERAGE HOUR PER INCIDENT				MICAP	
NUMBER OF ITEMS AWP	DA FORM 1352	NALDA	NALDA	REMIS	
FMC RATE	DA FORM 1352	NALDA	NALDA	REMIS	
PMCS RATE	DA FORM 1352	NALDA	NALDA	REMIS	
PMCM RATE	DA FORM 1352	NALDA	NALDA	REMIS	
NMCM RATE	DA FORM 1352	NALDA	NALDA	REMIS	
NMCS RATE	DA FORM 1352	NALDA	NALDA	REMIS	
RATE OF TECH CHANGE		TDSA	TDSA		
ENVIRONMENTAL CONCERNS	MANPRINT			IMPACT	
SUPPLY AVAILABILITY		NAVSUP	NAVSUP	WMER	SAMMS
TRAINING COSTS					
WARRANTY		GIDEP		GIDEP	

Note: Component data systems and process peculiarities are important considerations in trigger selection. The sources for business and technology triggers are frequently available in the commercial sector.

DATA SYSTEMS SOURCES

CAMS	Configuration and Management System
CCSS	Commodity Command Standard System
CSAR	Configuration Status Accounting Report
DA FORM 1352	Readiness Reporting Form
DRS	Deficiency Reporting System
ECP	Engineering Change Proposal
FLIS	Federal Logistics Information System
GIDEP	Government and Industry Data Exchange Program
LIDB	Logistics Integrated Data Base
LMDSS	Logistics Management Decision Support System
LSAR	Logistics Support Analysis Record
MCRC	Master Component Rework Cost (NADOC)
NALCOMIS	Naval Aviation Logistics Command Management Information System
NALDA	Naval Aviation Logistics Data Analysis

NAVSUP	Navy Supply System
NSNMDR	National Stock Number maintenance Data Record
PQDRS	Product Quality Deficiency Reporting System (G021)
REMIS	Reliability Maintainability Information System
RISC	Recoverable Item Simulation Capability (D041B)
RMPR	Reliability Maintainability Prediction Report
S^4	System Supply Support Status
SAMMS	Standard Automated Material Management System
STAMMIS	Standard Army Maintenance Management Information System
VAMOSC	Visibility And Maintenance Operation Support Cost (Navy Cost Analysis Center)
WMER	Wholesale Management and Efficiency Report (D035B)
WOLF	Work Order Logistics File

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APPENDIX I
ACRONYMS

ABPB	Aviation Business Process Board
A/C	Aircraft
ACAT	Acquisition Category
ADP	Automated Data Processing
ADUSDL	Assistant Deputy-Under Secretary of Defense For Logistics
AEB	Aviation Engineering Board
AG	Availability Guarantee
ALB	Aviation Logistics Board
ALS	Acquisition Logistics Support
APB	Acquisition Program Baseline
AFMC	Air Force Materiel Command
BTP	Build-to-Print
CAIV	Cost As an Independent Variable
CANDI	Commercial and Non-Developmental Item(s) (Also COTS)
CBD	Commerce Business Daily
CCA	Component Cost Assessment
CICA	Competition in Contracting Act
CLR	Chronic LRU/WRA Guarantee
CLS	Contractor Logistics Support
COD	Correction of Deficiencies
COMBS	Contractor Operated and Maintained Base Supply

COTS/NDI	Commercial Off-the-Shelf/ Non-Developmental Item (Also CANDI)
CPARS	Contractor Performance Assessment Reporting System
CSLW	Commercial Service Life Warranty
CRW	Component Reliability Warranty
DAU	Defense Acquisition University
DLA	Defense Logistics Agency
DLO	Desired Learning Objective
DMI	Depot Maintenance Interservice
DMS	Diminishing Manufacturing Sources
DMSDB	Diminishing Manufacturing Sources Data Base
DMSPIS	Diminishing Management Shortages Procurement Item Shortages
DMSMS	Diminishing Manufacturing Sources - Material Shortages
DoD	Department of Defense
DRFP	Draft Request for Proposal
DSMC	Defense Systems Management College
DTC	Design-to-Cost
DVD	Direct Vendor Delivery
ECOM	Electronic Component Obsolescence Management
ECP	Engineering Change Proposal
EMD	Engineering & Manufacturing Development
FAR	Federal Acquisition Regulation
FMC	Fully Mission Capable

F^3I	Form-Fit-Function-Interface
FFP	Firm Fixed Price
FMECA	Failure Modes Effects and Criticality Analysis
FPIF	Fixed Price Incentive Fee
FS	Flexible Sustainment
GAO	General Accounting Office
ICD	Interface Control Document
IEEE	International Electronic and Electrical Engineering
INITTR	Initial Time to Repair
IPD	Integrated Product Development
IPT	Integrated Product Team
JACG	Joint Aeronautical Commanders Group
JSGS	Joint Service Guide Specification
KPP	Key Performance Parameter
LCC	Life Cycle Costs
LCL	Life Cycle Logistics
LCM	Life Cycle Management
LECP	Logistics Engineering Change Proposal
LRU	Line Replaceable Unit
LSC	Logistics Support Cost
LSCG	Logistics Support Costs Guarantee
MAJCOM	Major Command
MBTP	Modified Build-to-Print

MC	Mission Capable
MCMT	Mean Corrective Maintenance Time
MDA	Milestone Decision Authority
MDT	Mean Down Time
MIL STD	Military Standard
MMT	Mean Maintenance Time
MOM	Micro Circuit Obsolescence Management
MP	Maintenance Planning
MPC	Maximum Parts Cost Guarantee
MR	Mission Reliability
MTBF-V	Mean Time Between Failures - Verification
MTBCF	Mean-Time-Between-Critical Failure
MTBD	Mean-Time-Between-Demand
MTBF-VT	Mean-Time-Between-Failures-Verification Test
MTBM	Mean-Time-Between-Maintenance
MTBR	Mean-Time-Between-Removal
MTBSM	Mean-Time-Between-Scheduled Maintenance
MTBUM	Mean-Time-Between-Unscheduled Maintenance
MTM	Mean Troubleshooting Maintenance
MTTR	Mean-Time-to-Repair
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command

NDI	Non Developmental Item
NGS	Non Governmental Standards
NMC	Not Mission Capable
NSN	National Stock Number
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
ORD	Operational Requirements Document
OS	Open System(s)
O&S	Operations and Support
PAC	Product Acceptance Criteria
PBBE	Performance-Based Business Environment
PCO	Procurement Contracting Officer
PDES	Product Data Exchange Specification
PH	Possessed Hours
PM	Program Manager
PMC	Partially Mission Capable
PPA	Product Performance Agreement
PRAG	Performance Risk Assessment Group
R&MIW	Reliability and Maintenance Improvement Warranty
RBL	Reliability Based Logistics
RCM	Reliability Centered Maintenance
RFP	Request for Proposal
RIW	Reliability Improvement Warranty

R&M	Reliability and Maintainability
R&MW	Reliability & Maintainability Warranty
RTOK	Retest Okay
RW	Reliability Warranty
SAE	Society of Automotive Engineers
SE	Support Equipment
SECDEF	Secretary of Defense
SESG	Systems Engineering Steering Group
SOR	Source Of Repair
SPL	Spare Parts Level Warranty
SRA	Shop Replaceable Assembly
SRU	Shop Replaceable Unit
TAT	Turn Around Time
TBAM	Trigger Based Asset Management
TM	Technical Manual
TOC	Total Ownership Cost
T&RIG	Test & Repair Improvement Guarantee
ULW	Ultimate Life Warranty
UR	User Reliability
WOS	Warranty of Supplies
WRA	Weapon Replaceable Assembly
WSR	Weapon System Reliability