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Procurement

GUIDE FOR THE PREPARATION AND USE OF PERFORMANCE SPECIFICATIONS

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COMMITMENT TO EXCELLENCE

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The use of performance specifications to acquire defense products will reduce overall costs and will permit greater contractor operational freedom to build the product, while motivating process control and continuing process improvement. The aim of this Pamphlet is to assist DOD personnel, including specification developers, end-item users, and procurement personnel, in the development of specific essential product characteristics to be used in the acquisition of defense system and equipment at reduced cost. The objective of this Pamphlet is to describe a process for using performance specifications, which can assist in the transition from TDP-based procurement to performance specification and Best Value acquisitions. This is not a textbook on writing such specifications; rather, this Pamphlet is intended to encourage users and acquisition personnel to focus on specific essential product requirements as a way to streamline the acquisition process.

FOREWORD

The greatest challenge facing the DoD acquisition community during the last decade of the twentieth century is to remove all non-value-added costs from the acquisition of products for our defense forces. The collective overhead costs within DoD and industry for management and control purposes are estimated at twenty to forty percent of the acquisition budget. As defense spending decreases, these costs could grow to a much higher percent of the acquisition budget if changes are not made. Of equal importance, unless these changes are made quickly, companies comprising the Defense Technology Industrial Base (DTIB) may not remain competitive in the global marketplace, and defense modernization will be significantly impaired.

The use of performance specifications to acquire defense products will reduce our overhead costs. The performance specification will permit greater contractor operational freedom in addressing "how" to build the product, while motivating process control and continuous process improvement. Performance specifications will enable savings to be realized by the Government by reducing the need for technical and administrative oversight. Contrary to common belief, performance specifications can enhance competitive procurement, including procurement of repair parts; maintain interchangeability of parts; and continue to define the detailed configuration of the item being produced.

The purpose of this Pamphlet is to provide guidance on the preparation and use of performance specifications, and a better understanding of the benefits that will be realized from them. Information contained in this Pamphlet is based on the successful use of performance specifications for acquisition of technologically superior products at reduced cost. This Pamphlet (AMC-P 715-17) shall be used by all AMC procurement activities to help reduce acquisition costs and enhance business relationships with our suppliers.

Experience gained through the use of performance specifications may result in further refinements to this Pamphlet. Suggestions for such refinements should be submitted to the Principal Deputy for Acquisition, HQ USAMC.

Approved by: [signature]

D. L. Griffin
Principal Deputy
for Acquisition

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AMC PAMPHLET
No. 715-17

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APPENDIXES

FIGURES

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CHAPTER 1

EXECUTIVE SUMMARY

1.1 THE NEED FOR ACQUISITION REFORM

The Carnegie Commission on Science, Technology and Government, in a May 1993 study, recommended that "**the Secretary of Defense undertake, with high priority, a radical reform of the defense acquisition system.**" It further stated that "the many studies on defense acquisition agree that the system is bloated and inefficient and have made detailed recommendations on how to improve it, but previous attempts have failed because they tried to build on a fundamentally flawed foundation." The Commission noted that:

> *What is needed is a complete break with the present system, and the creation of a new system based on the best of the acquisition processes used by large corporations when they undertake major development projects, such as a new generation of commercial transport aircraft. Such a new system would allow the integration over time of the defense industrial base with the commercial industrial base - an integration that will bring not only major benefits to our national security but also important improvements in the competitive posture of many of our largest corporations.*

The full text of the Commission's report, "New Thinking and American Defense Technology: A Radical Reform for the Defense Acquisition System," is contained in appendix A-1 of this pamphlet. Its discussion of the background, current problems, and recommended solutions recognizes the issues discussed in this pamphlet, as well as some of the ongoing efforts within the services to improve the procurement process, such as Best Value contracting.

The Commission notes that there are many significant differences between the commercial and defense industrial bases. **One of the very notable differences is the widespread use of performance specifications in the commercial industrial base, rather than the widespread reliance on the "build-to-print" approach used in the defense** environment. Use of performance specifications offers the DOD an opportunity to reduce acquisition impediments.

1.2 PURPOSE

The aim of this pamphlet is to assist DOD personnel, including specification developers, end-item users, and procurement personnel, in development of specific essential product characteristics to be used in the acquisition of defense systems and equipment at reduced cost. This is not a textbook on writing such specifications; rather, this pamphlet is intended to encourage users and acquisition personnel to focus on specific essential product requirements as a way to streamline the acquisition process. It will also cause them to question a preconceived need for the traditional detailed Technical Data Package (TDP) requirements, particularly those that add cost to the Government with little or no value added.

1.3 CONCEPT

The success of a procurement action relies on the specification being a true and accurate statement of the user's requirements. Preparing a specification is a key part of the acquisition process. A good specification ensures that the Government observes the principle of open and effective competition. A specification should be explicit in defining the product requirements. It should not restrict competition and innovation by specifying precisely "how to" achieve those requirements.

The use of performance specifications is not unique. Performance specifications are widely-used in the commercial marketplace with great success, and have been used on a more limited basis within the Army with equal success. Recent examples of their application include procurements for the Army's new training helicopter and many night vision items.

A properly constructed performance specification can assure the Government a quality product at reduced cost, and greatly reduce Government oversight and contract administration. In addition, contracting to a performance specification allows the contractor to become more efficient in his operations; to incorporate product enhancements; and to reduce both direct and indirect costs associated with the production effort.

The objective of this pamphlet is to describe a process for using performance specifications, which can assist in the transition from TDP-based procurement to performance specifications and Best Value acquisitions. When preparing any specification, writers should use judgement and common sense in deciding what to include or leave out. Thinking about the issues raised in this pamphlet will help writers make such decisions wisely.

Each purchase requires its own specification. Because of the variety of materiel and services purchased, it is not possible in this document to offer guidance on what should be included in each and every specification. Rather, the pamphlet identifies the types of issues that should be considered when preparing a specification, using the four-step process discussed in the following section. While this pamphlet is primarily intended to assist in the preparation of performance specifications, the principles and details outlined are generally applicable to all types of specifications, and are discussed in greater detail in Section 1.6, Program Summary, and in the following chapters.

Writing a specification need not be difficult, and the specification does not have to be long or complex. By following the ideas presented in this pamphlet, and keeping an open mind, the task should be a lot easier. The specification should help provide the best product to the user at the Best Value to the American taxpayer.

1.4 CURRENT ENVIRONMENT

Historically, DOD has procured the vast majority of its materiel to detailed TDPs. These TDPs include military specifications and standards; detailed manufacturing drawings; manufacturing processes; and detailed inspection procedures, test equipment and gage designs. Justification for detailed Government (customer) controlled TDPs has been to assure the quality of the product; to provide configuration control; to achieve part standardization; and to support competitive procurement and production of the item. This "build to print" philosophy requires that the TDP take precedence over any performance specifications; requires a high level of technical and contract administrative activity by both the contractor and the Government; limits opportunities to propose design improvements for either performance improvement or cost reduction; offers little opportunity or incentive for the contractor to improve either the product or his manufacturing processes; and, therefore, limits cost reduction opportunities. While defenders of the current TDP system might argue that "contractors always have the opportunity through the engineering change process," reality argues otherwise. Unless the change is urgent (e.g., safety-related), cycle time for implementation is typically 3 months to more than a year, and in some instances the contractor has been actively dissuaded from submitting any changes that did not have safety implications!

The TDP-based acquisition process is shown schematically in figure 1-1. In this figure 1-1, and throughout this pamphlet, the following terms are defined:

- The "user" is defined as the ultimate consumer of the item, the one who has identified the original need for the item - that is, the soldier in the field.
- The "customer" is the procuring activity - for example, some major subordinate command or activity within the U.S. Army Materiel Command (AMC).
- The "offeror" is an industrial concern who submits a proposal against a Government requirement - the company becomes the "contractor" if he is selected by the Government to produce the item.

In the process shown in figure 1-1, the TDP forms the basis of the acquisition need and the offerors' proposals, with contract award based on the low-cost technically acceptable (to the TDP) proposal.

1.5 DRAWINGS AND TECHNICAL DATA PACKAGES

Although performance specifications have been used successfully in the procurement of items, their use has been resisted. This resistance can be attributed to beliefs that--

- There would be no detailed drawings to define the product.
- The ability to maintain product interchangeability would be adversely affected.
- The capability to competitive procure of spare/repair parts would be degraded.

These beliefs are not valid. The product drawings are also necessary when performance specifications are used. The manufacturer must still make a product which conforms to product drawings. The difference is that the contractor has configuration management responsibility for the product drawings rather than the Government, who only exercises management control over the performance specification. The contractor has authority to make changes to his product drawings, provided these changes do not adversely affect any of the requirements defined in the product performance specification. These requirements would include such items as interchangeability of spares and repair parts as well as product performance.

The use of performance specifications does not preclude the Government from purchasing spare/repair parts on a competitive basis. The parts can be purchased using the contractor's product drawing(s). As a part of the performance specification acquisition process, the Government would have already--

- Predetermined data rights in the drawing package claimed by the contractor.
- Negotiated an option to acquire the drawing package, in contractor format, to use for this purpose.
- Received a warranty from the contractor that the hardware can in fact be built from the drawing package, and that he has done so.

1.6 PROGRAM SUMMARY

The process of using performance specifications involves four steps. The four steps in the process flow back and forth between the Government and its industrial base, as shown in figure 1-2, and represent a steady progression away from the TDP-driven procurement approach used today, and focuses on the needs of the true customer, the user. Such a shift in focus will help ensure better fulfillment of the user's needs, and help to break the grip of obsolete fabrication requirements that do not benefit the user.

The process has application from initiation of development of the item, where there is a need for the development and qualification process for the item or system in question. The use of performance specifications does not negate the development process, nor the Government's participation in that process. However, the acquisition process, and not development, is the primary focus of this pamphlet. It is assumed that the developed item, as described by the drawing package which exists at the conclusion of a development program, accurately represents both the hardware and the stated needs of the user, and is suitable for use in the acquisition process. The four steps in that process of many performance specifications are as follows:

- **Government - Solicitation Preparation.** The Government identifies the essential performance requirements to be included in the solicitation, and performs a "zero-base scrub" on all requirements proposed for inclusion. The Government should conduct in-depth dialogue with potential offerors through draft Requests for Proposal (RFP) and pre-proposal conferences, to ensure that both the requirements of the Government and the range of offeror capabilities are understood. This dialogue, including the user, the procuring activity, and potential offerors, will ensure that the required performance is precisely defined. Under a Best Value concept, the Government also identifies areas of consideration for performance improvements which might be proposed. The RFP limits the amount of information to be submitted by offerors to only those areas which will help the Government determine which offeror will provide Best

Value, and those that are necessary for the offeror to demonstrate compliance with the requirements of the RFP. It references the current specification and TDP for the item, if available, as being for information only. In so doing, it offers the opportunity to enhance the expansion of innovation and production improvements.

Incorporating a user evaluation as part of the source selection process is often the best way to cover all aspects of the design without restrictive "how to" requirements, while still protecting the user from the unexpected and/or the unacceptable. User evaluations are best set up in a commercial or non-developmental Item (NDI) buy; however, even a prototype evaluation is better than surprising the ultimate user with the results of a "purely paper" exercise. For example, a user evaluation was used as a part of the training helicopter source selection mentioned above.

There is a danger in developing performance specifications, in that they may end up being more qualitative than quantitative. Great care must be taken to ensure that parties submitting proposals - and evaluating them - are equally clear on exactly what the Government requirements are. RFPs and proposals which are not based on quantitative requirements and data become extremely sensitive to varying interpretations and misunderstanding. Without specific attention to clarity in the development of the specification, it becomes very difficult to evaluate proposals against a common standard, and to enforce performance after contract award.

- **Contractors - Proposal Preparation and Submission.** Working from the final solicitation, the prospective contractors develop their own performance specifications, which incorporate their products' performance and their proposed approaches to satisfy the requirements defined by the Government. In addition, they may propose improvements above the minimums to improve their respective competitive positions in providing the most cost-effective item to the Government. As a part of this process, they identify changes to the TDP, and any impact(s) on such issues as logistic support or reliability, and environmental impairment. The offerors also provide their quality assurance and warranty provisions. In offerors' proposals, information documenting compliance with functional statement of work should be submitted as substantiating data, in order to avoid including "how to" information within the specification, and to avoid identification of proprietary processes which could tend to drive the specification to sole source.

- **Government - Best Value Source Selection.** The Government source selection process will choose the Best Value proposal through an integrated assessment, considering factors such as price/cost, operational capability, past performance, quality, environmental management practices, reliability. availability, and maintainability (RAM), and Integrated Logistics Support (ILS), rather than price alone. In selecting the Best Value proposal, the Government has effectively established a new Product Baseline, which incorporates all of the improvements above the minimum requirements that were a part of the successful offeror's proposal. In this way, the specification of the selected contractor then becomes the Government's specification as well, and is still suitable for competitive reprocurement at a later date. Best Value is a combination of competitive pricing and improved performance. Such improvements may consist of deletion of obsolete requirements and/or improved performance with direct operating benefit to the user. The benefits of such changes should be subject to user review as part of the source selection process, to determine if such performance increases are in fact true enhancements of intrinsic value. Reprocurement of the item can then use the current contractor's specification as the basis, if such user assessments have indeed validated the desirability of accepting the proposed improvements.

- **Contractor - Item Production.** The selected offeror maintains the TDP for the item. He produces the item, performs necessary quality assurance examination and test, provides a Certificate of Conformance, and warrants the product's performance against the performance specification he has agreed to contractually. Note that the contractor can <u>not</u> unilaterally change any of the requirements identified in the specification, since these performance requirements form the basis for both his selection and his hardware.

Reprocurement of the item through another competitive procurement action will follow the same process. In this case, however, the Government, in preparing the solicitation, will use the current contractor's performance specification and drawings (if available, but for information only) as the baseline, and will identify areas for Best Value consideration from this new baseline. As a result, the Government can reap the benefits from increasing technical capabilities or cost-reduction opportunities in the marketplace with each succeeding buy. In order to ensure that logistics support for the item does not become overburdened, interchangeability to the spare part level may be required, and changes which affect this function must be carefully weighed before being implemented. A good operational level of repair analysis (LORA) should be performed up-front - it may be that the part(s) in question shouldn't be spared at all. If a LORA was not done at program initiation, a "mid-product-life analysis" to establish a baseline may still yield benefits.

In this manner, the Government derives the ability to procure materiel in a manner which is more analogous to the commercial community, where the best capability for the best price - Best Value - becomes the basis for contractor longevity, and supports maintenance of the Defense Technology and Industrial Base (DTIB). It also moves the Government toward the goal of telling offerors what it wants, and not "how to do it."

Examples within the Army were cited above where this approach has been used in the recent past. Results from one such procurement process, with awards to dual sources in a very high-technology environment, is offered as an example of its effectiveness. In 3 separate multiyear contracting actions, the price of the item was reduced by more than two-thirds, while the performance was increased significantly with each successive procurement.

The process described above varies from the "traditional" method of developing specifications, and requires a cultural change to implement within the acquisition process. It is not impossible to accomplish, and has already been implemented most effectively by some organizations. Chapters 2 and 3 provide background on current issues, as well as current initiatives to address these issues, so that users of this pamphlet will more clearly follow the subsequent discussions.

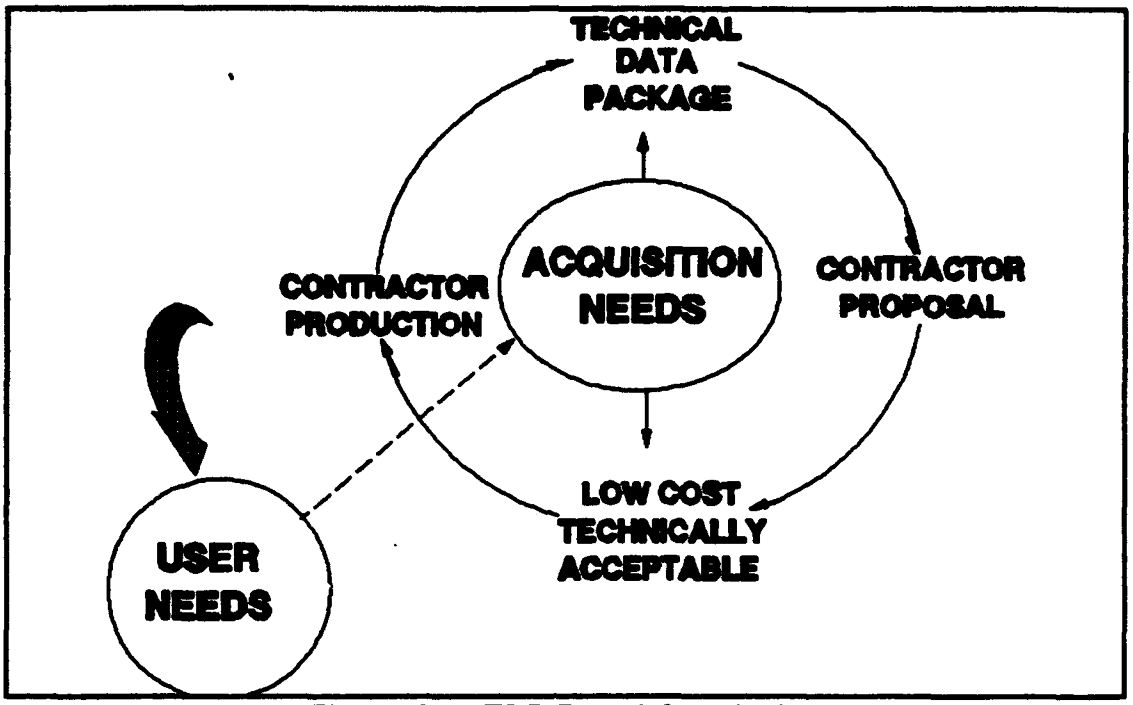

Figure 1-1 TDP Based Acquisition

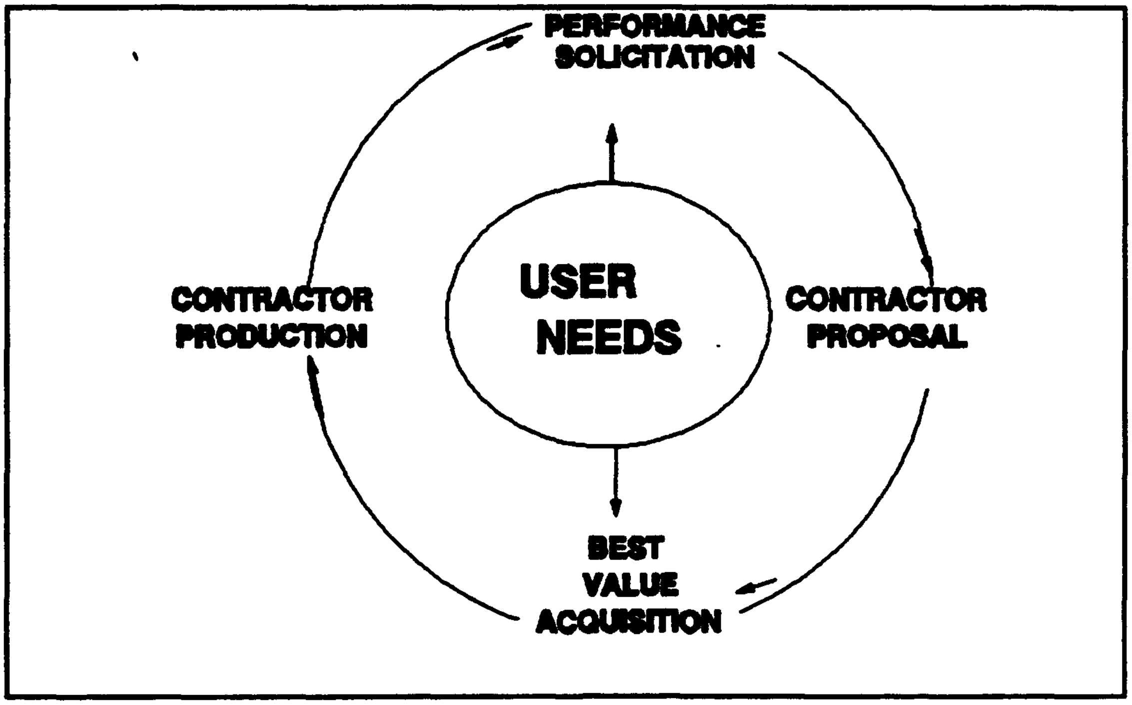

Figure 1-2 Performance-Based Acquisition

CHAPTER 2

BACKGROUND

2.1 INTRODUCTION

Over the past several years, there have been studies and programs conducted by both the Executive and Legislative branches of the Government. These efforts have included both investigative studies to identify problem areas in the Defense acquisition process, as well as new initiatives implemented to address some of the problem areas identified. Some of the most applicable efforts related to the use of performance specifications and maintenance of a strong industrial base are discussed in the following sections.

2.2 *BUILDING FUTURE SECURITY*

The Congressional Office of Technology Assessment (OTA) final report, *Building Future Security*, provides an assessment of the DTIB. The report discusses strategies for moving to a smaller and more efficient DTIB over the next decade and maintaining that base in the future.

The anticipated cuts in defense spending will require a fundamental restructuring of the DTIB to (1) reallocate resources from short-term military capabilities to long-term military potential, and (2) exploit the synergies that can result from a closer integration of the research and development (R&D), production, and maintenance elements of the base. The cold war mobilized a significant portion of private industry and expanded the Government's military research, production, and maintenance facilities. The end of the cold war requires the demobilization of many private and Government facilities.

OTA concluded in it's report, *Redesigning Defense*, that the DoD faces the choice of greater integration with the civilian industrial base or maintaining a defense-unique base that will most likely devolve to a set of sole-source providers ("arsenals") in the public and private sectors. Several studies have found that increasing the integration between military and civilian technology and production will lower overall defense costs, promote technology transfer, increase available industrial capacity, and strengthen the economic dimensions of national security. These studies include two Defense Science Board Reports on the use of commercial items for defense, a Defense Science Board Study on the defense industrial base, and a study by the Center for Strategic and International Studies on civil-military integration. OTA reported that their discussions with industry and Government personnel support these conclusions. The expected deep reductions in defense spending make civil-military integration all the more important.

The objective should not be to maintain current capacity, but to ensure the proper mix and size of future DTIB facilities. How this is done will vary by industrial sector and technology. The Government may have to intervene to preserve militarily unique facilities for tank assembly, nuclear submarines, and ammunition. Technologies and industrial sectors with more civil applications (e.g., aircraft, automotive, electronics, fasteners, and clothing) can probably be maintained entirely in the civil sector. **Even so, this approach would require changes in DoD acquisition practices such as eliminating overly rigid military specifications and designing military systems to allow use of commercial components.**

Peacetime production efficiency will be enhanced by lowering barriers between defense and civilian elements of the DTIB. These barriers, including special accounting requirements for defense contractors and detailed military specifications and standards, were created to safeguard public funds and ensure quality. But they also increase defense acquisition costs, place extra burdens on defense contractors seeking to diversify into the civil sector, deter leading edge commercial firms from participating in defense work, and obstruct the flow of technology between the two sectors. A solution would be to absorb the defense production base into the civil base, leaving only a few military unique products (e.g., tanks, nuclear submarines, and military-peculiar ammunition) to be built and maintained in defense facilities. As a minimum, the DOD should continue its efforts to procure more products off-the-shelf and to reduce excessive oversight and specifications through management reforms that shift more responsibilities to producers.

Integrating the defense base back into the larger industrial base will require changes. The OTA has identified two general courses of action that could be followed:

> One involves changes within the current defense acquisition system. Examples include such programs as the Corporate Risk Assessment Guide (CRAG) developed by the Defense Contract Auditing Agency to reduce the number of on-site inspectors in key financial areas; the Exemplary Facility (EF) program, which has been tested in a number of manufacturing facilities in the past 2 years; and the Army's Continuous Process Improvement Program (CPI). While such programs have the objective of reducing oversight and therefore reducing costs, they all suffer from inadequate Government support - especially a lack of support by relevant DOD oversight agencies -and a subsequent lack of industry incentive to participate. For example, the EF program was recently discontinued by the office of the Secretary of Defense (OSD) with little discussion with the companies involved. Future efforts to reform the acquisition system will require broad-based support within the DOD if they are to succeed.
>
> The second course is to make much wider use of 'commercial standards' in auditing and production, i.e., a broad direct effort at increased civil-military integration of the base. This course offers greater potential benefits than limited change within the DOD system. For example, acceptance of commercial standards in place of military standards (e.g., replacing Mil-Q-9858A with International Standards Organization (ISO) 9000) has been proposed by many in industry, but has not been acted on favorably by the DOD. Even if this change were made, the DOD's need for accountability would be different from that of the civil sector. Advocates of civil-military integration argue that, nonetheless, the regulatory barriers to doing DOD work should be lowered and more firms

brought into the defense business, at which point accountability can be better assured through real competition.

The DTIB will be smaller, but must still be capable of supporting the DOD in its role as a deployable, strategic force. **An aggressive role must be taken in identifying the qualities that are required and then ensure that those qualities are enumerated in the acquisition strategies and solicitations. Which companies stay in the defense business is decided every time a contract is signed. These qualities must be in every request for proposal and the source selection process.** If they are, we will in effect be buying not just the immediate product, but also the DTIB that will support us into the next decade. The AMC Acquisition Goals and Initiatives, discussed in the next section, reflect the qualities required for the DTIB.

2.3 AMC ACQUISITION GOALS

The Army Materiel Command (AMC) has recognized these challenges in the Acquisition Strategy White Papers and the Acquisition Improvement Workshops. In order to meet these challenges, AMC has established the following goals:

1. Integrate the U.S. defense and commercial industrial sectors to achieve an efficient, total industrial base.

2. Remove barriers that prevent industry from making full use of commercial markets to support the total industrial base.

3. Produce the highest quality solicitations and reduce unnecessary, non-value-added Government-imposed requirements.

4. Ensure that environmental concerns become an integral part of the acquisition cycle, to ensure that DOD acquisition programs and production facilities will be in compliance with applicable environmental and occupational health laws, both now and in the future.

5. Select and award contracts to the highest quality, best Value contractors.

Performance specifications and performance based contracting are key elements in achieving these goals.

2.4 INITIATIVES WITHIN AMC

In recent years and continuing today, AMC has had a series of initiatives to improve the manner in which it procures required hardware and systems. Some of these initiatives, discussed in the following sections, have included such acquisition concepts as buying on a commercial basis; eliminating non-value-added requirements; Best Value contracting; and the AMC Continuous Process Improvement program. The overall intent of these efforts is to facilitate procurement of quality systems that meet the user's requirements; get these quality products from quality contractors; and give these contractors the flexibility and freedom in the design process to incorporate innovative approaches without being constrained by specification or contractual issues which limit that creative flexibility while adding no value to the final product. Although some of these initiatives are discussed in the following sections as if they are stand-alone efforts, they are all interrelated, as shown in figure 2-1.

2.4.1 BUYING ON A COMMERCIAL BASIS

Over the years, a wide gulf has grown up between the commercial and defense industry. While it is recognized that some defense requirements can not be met in some areas by products from the commercial sector, the imposition of Government-specific requirements which may add little or no value to the product has often served as a barrier to companies and prevented them from proposing on solicitations within the DOD, leaving a limited base from which to purchase needed equipment. The importance of such a barrier becomes even clearer in today's environment. Recognizing the reality of the declining budget, it can be expected that some contractors who do not receive awards in the near future will leave the defense industrial base.

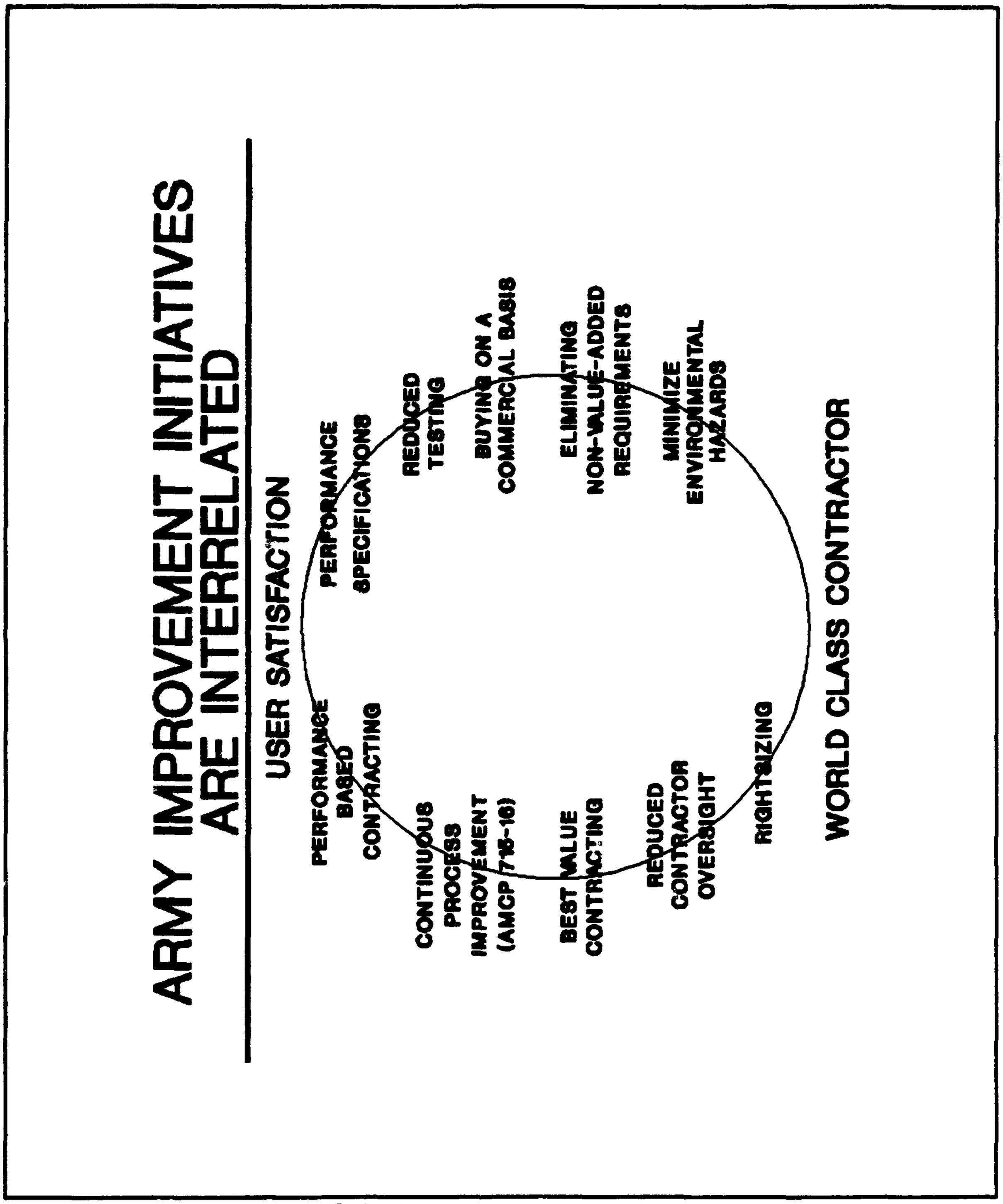

Figure 2-1 Army Improvement Initiatives

It's not that these companies are, by definition, poor suppliers. Often, it's just that they no longer retain the so-called "critical mass" of direct labor hours and/or material dollars against which to allocate the large amount of indirect costs necessary to support Government programs. As will be discussed in the next chapter, a study by the American Defense Preparedness Association (ADPA) found that the Government pays a penalty above the cost of commercial companies to acquire hardware. The relative magnitudes of functional elements in commercial and Government programs indicate that the majority of the commercial/Government discrepancy is in the areas of quality and administration. The Government, through imposition of inspection requirements and "paper trails" on the contractor, enforces a higher percentage of non-value-added work, while the commercial market relies on a strong warranty program which puts the contractor at risk. While the contractor may be willing to perform non-value-added effort within the contract (remember, the contractor <u>does</u> get paid for all of it), it hurts both sides: with these funds being expended for such non-value-added effort, it means that there is less money available for other needed systems (the DOD impact) to be procured from other contractors. Contractor product liability in the commercial arena is often a much larger incentive for quality than Government inspection program.

2.4.2 ELIMINATION OF NON-VALUE-ADDED REQUIREMENTS

The first step in achieving a better specification (of <u>any</u> type) would obviously be the elimination of non-value-added requirements. Simply put: what requirements are being levied on prospective contractors as a part of the RFP which are not essential to the design and/or production of the system? Many of these are buried in innocuous references or paragraphs in the RFP, and may deal with compliance with MIL-STDs, and other Government documents - it's always easier to reference a document that "covers the waterfront" than it is to identify exactly what the few critical elements <u>are</u>. In addition, many of these requirements are "buried" elsewhere, such as in the contract itself, or in the data items. Studies have noted that compliance with these requirements, and the administrative paperwork to "prove it," are two of the most significant discriminators between the Government and commercial cost differentials.

To focus attention on this issue, the Commander, AMC and the Assistant Secretary of the Army (Research, Development and Acquisition) (ASA(RDA)) reiterated their concern in a letter to the Army acquisition community in August 1992. This letter specifically directed program managers (PM) and program executive officers (PEO) to "challenge functional requirements in every aspect of an acquisition," and to "review all non-contractual functional requirements, and challenge those that appear excessive or do not add value to the Army." The ASA(RDA) followed up with a similar letter to chief executives of major defense companies reiterating this same point in September. Copies of these letters are included in appendix A-2.

Many of the non-value-added costs <u>are</u> contractual, however - they're contained in Section 2 of the specification ("Applicable Documents"); in the Contract Data Requirements List (CDRL); or within the contract language itself. As an example of this, appendix B contains a reprint of Section 2 of a MIL-Spec for electronic equipment (which <u>itself</u> might be referenced in a contract or specification). Note that Section 2 is many pages long, and includes standards for such items as wood screws, leather dressing and three types of plywood. Any requirements scrub clearly must start with these parts of the specification which, directly or indirectly, may tell the offerors "how to do it" or "what he must do," and <u>not</u> what the DOD really needs. As noted earlier, the specifications must take precedence over the drawing package in both the RFP and the contract.

2.4.3 BEST VALUE CONTRACTING

One of the major initiatives in recent years has been the implementation of programs to procure system requirements on the basis of integrated assessments using factors such as price/cost, past performance, quality, producibility, RAM/ILS, Manpower and Personnel Integration (MANPRINT), operational performance, life cycle cost, and user satisfaction, rather than price alone. This practice has become known as "Best Value," i.e., the best overall value to the Government. The approach is described in DOD Instruction (DODI) 4105.62 E(3)(d), and also in subsequent OSD acquisition policy circulars. As might be expected, this approach has been particularly successful in applying the Best Value principles in the acquisition of NDIs.

Under Best Value source selection evaluations, the Government attempts to quantify the value or worth of individual areas within the offerors' proposals. This quantification can be expressed in explicit dollar terms, or, as is more often the case, as a risk/benefit assessment for individual proposal areas. After risk/benefit assessments and overall merits of each proposal are compared, the Government makes a considered judgement as to which proposal represents the overall "best value" to the Government and should be selected for contract award.

To receive the maximum benefit, the Government must create an environment in which to apply it. This would entail such things as--

- Elimination of non-value-added requirements.
- Consideration of the applicability and adequacy of commercial and industrial standards, whose use could provide reduced costs with no degradation in quality or performance.
- Verification that the specifications and standards which <u>are</u> called out in Section 2 of the specification are applicable, accurate, current, and complete.
- Verification that the prescribed levels of testing and/or inspection called out in the specification are both necessary and cost-effective.
- Verification that data requirements in the CDRL reflect minimum needs, and are adequate from a cost-benefit standpoint.

Some considerations in Best Value contracting include the following:

- The user must play a major role in determination of "best value." User requirements must be clearly articulated, and proposed technical benefits and enhancements must be evaluated from the user's standpoint. This could be accomplished effectively by delineation of "targets of opportunity" in the RFP (an example is included in Section 6.7); discussions with potential offerors during the solicitation preparation process cited in chapter 1; and by user participation in the source selection process.

- The Government should identify to industry what it sees as "targets of opportunity" for added value. These would generally take the form of technical or performance enhancements.

- The Best Value decisions must be sound - the additional benefits clearly equal the added cost (if any).

- Contractor performance must clearly be a consideration in the source selection.

- Product improvements can be greatly enhanced. If an item is competitively selected through Best Value contracting, its technical performance establishes the baseline for the next Best Value procurement of the item.

- The contractor's ability to propose value-added enhancements through use of performance specifications is greatly enhanced, since the Government can consider them under Best Value.

- *Offerors' past performance must be carefully evaluated, in order to be able to* accurately develop a risk assessment for each offeror.

- Recognize the possibility of a protest, and be prepared to provide rational explanations for both the criteria and the evaluation process.

2.4.4 CONTINUOUS PROCESS IMPROVEMENT

The preceding sections have addressed identifying and removing unnecessary requirements, and about giving the contractor the ability to use innovation and disciplined practices to provide a quality product which meets the DOD's needs. The question then becomes: how does the DOD find these contractors, assure that long-term business relationships can be developed with them, and assess their capabilities to ensure that this additional flexibility will provide quality products in a timely manner at lower costs?

To address these issues, AMC developed the Continuous Process Improvement (CPI) methodology. The objective is the assessment and measurement of contractor performance against uniform and definitive standards of excellence, and the motivation of contractors to improve their processes, thereby improving quality and reducing costs. The assessment looks at all aspects of the contractor's performance, and is not confined to the traditional functional reviews which are currently conducted. Since the methodology objectively measures contractor performance through the use of well-defined metrics and focuses on minimization of subjective assessment criteria, it can then be used as a tool to enhance "best value" source selections. A self-assessment/self-improvement technique for the contractors is one of the features of the CPI methodology. Under this concept, a contractor continuously assesses his performance, and develops a self-improvement plan to reach the established standards of excellence.

Implementation of the CPI methodology offers numerous advantages to both the Government and Industry. From the Government's perspective, these include--

- Quality products delivered on time and at a reasonable price.
- Continuous improvement in product quality and reliability.
- Reduced product operating and support costs.
- Reduced lead times.
- Reduced need for facility surveillance
- Reduced environmental impact and liability,
- Full and open competition.
- Heightened user satisfaction.
- Enhancement of overall industrial readiness and mobilization capability.

From the industry perspective, CPI provides--

- Improved competitive position.
- Increased sales and profit potential.

- Expanded business base and company capability.
- Enhanced facility reputation.
- Greatly-reduced proposal preparation requirements.
- Performance consideration in source selection process.
- Elimination of Government "in-process" acceptance inspections.
- Minimum Government oversight.
- Reduced contract administration cost.

During the source selection process, contractor initiatives will be evaluated on a Best Value basis. The source selection process may also include such considerations as the lower overall administrative and data costs when dealing with a "certified" contractor, and the decreased risk associated with various elements of the technical, management and cost proposals. While certified contractors may have a competitive advantage over noncertified ones, the evaluation methodology will be such that all offerors will be treated fairly, and full and open competition is maintained. This methodology is defined and described in AMC-P 715-16, "Program For Continuous Process Improvement."

CHAPTER 3

PRESENT SPECIFICATION PRACTICES AND POLICIES

3.1 INTRODUCTION

The objective of any procurement action is to buy what is needed when it's needed at a reasonable price. In traditional competitive procurements, contracts are awarded to the lowest-priced, responsive, responsible contractor. In a "Best Value" environment, the added benefits offered to the Government are weighed against the added costs which may be required in order to gain these benefits. In many procurements, technical compliance is a primary selection criterion, and it is therefore essential that the specification(s) for the item are of the highest standard. Unfortunately, past experience indicates there is a high probability that a proportion of the specifications used by DOD contain a number of significant faults (which increase cost with little or no added value).

3.2 PAYING A PREMIUM FOR DEFENSE PRODUCTS

A recent ADPA study found that the DOD pays a premium of between 30 and 50 percent more for products than for the same or similar items sold to a commercial enterprise. The variances are primarily functions of the products themselves, and the degree of company exposure to DOD laws, regulations, military specifications, standards, and procurement practices. In some cases, the cost may be 100 percent higher. The major finding of the study is that doing business with the DOD adds cost without adding commensurate value.

The ADPA study identified military specifications and standards as significant cost drivers. Over time, Government specifications and standards have grown to stress the "how to" in all aspects of business operations and technology innovation. This is in sharp contrast to that which is customary on the commercial side, where contracting for "what" and "when" while avoiding the "how to" is commonplace. In addition, Government oversight, including the Defense Contract Management Command (DCMC) and the Defense Contract Audit Agency (DCAA) in addition to the procuring agency, requires compliance and validation of the "how to," which adds additional cost. Indeed, other recent studies have identified the major areas of cost increase between Government and commercial procurements as being most evident in the quality and administrative areas - compliance and verification, and the paper trail of data to certify it. Appendix B contains an example of Section 2 requirements from a detailed military specification.

The Acquisition Law Advisory Panel on Streamlining Defense Acquisition Law noted in its report that:

> "The specification and standard problem -- over-specification and detail enforced by large numbers of auditors and inspectors -- arises without clear delineation from statutes, regulations, good intentions, practices, and habit. The problem for a commercial company, as with Government-unique accounting principles, is that compliance with Government standards often requires a departure from commercial practices, not to mention the company's own processes which have lead to commercially successful products. To the extent that DOD standards are out of date or out of touch with commercial practice, the cost of compliance increases."

Given the present state of DOD specifications and TDPs, it is noteworthy that current DOD policies and guidelines for the preparation of specifications emphasize that requirements should be stated in performance or "what-is-necessary" terms, as opposed to telling a contractor "how-to" perform a task. In the past, too little concern has been placed on the cost ramifications caused by the preparation of specifications.

3.3 TYPICAL SPECIFICATION PROBLEMS

The subject of deficient specifications with their subsequent impact on increased cost and schedule have been addressed previously in various forums. The main problem areas are briefly discussed below, and include--

- Restrictive specifications or overspecification.
- Usage where a particular preference for one manufacturer's product is predetermined, or when essential requirements have not been fully researched.
- Situations where specification requirements are employed to assure poor quality items are not offered, or to prevent recurrence of prior deficiencies.
- Special purpose specifications, similar to overspecification, where essentially commercial equipment becomes "special purpose."
- No provision to permit use of current revisions of specifications or standards that are later than those cited in the requirements and there is no impact to the current or previously-manufactured product.
- Underspecification, or missing specification requirements, which may then be added after the preliminary design has already been developed.
- Specifications which impact the environment and cause health and safety concerns.

3.4 DOD SPECIFICATION POLICIES

DOD Directives and Military Standards (MIL-STD-490A and MIL-STD-961C) provide guidelines for the preparation of specifications and associated documents. Of particular relevance are the following instructions for the preparation of specifications contained in MIL-STD-961C.

- For commercial products, before developing a new military specification, or revising an existing one, consideration should first be given to developing a non-Government standard or including DOD requirements in an existing non-Government standard), or developing or revising a commercial item description or federal specification.

- To the extent possible, requirements should be stated in performance or "what-is-necessary" terms, as opposed to telling a contractor "how to" perform a task.

- Care should be taken to avoid unnecessary reference to other standardization documents and document "tiering" (appendix B is an example of this). References should be justified. When only a portion of another document needs to be referenced, only that portion should be referenced. Allow for tailoring of document references when this is appropriate.

- Strong justification and extreme care is necessary when referencing management system or program type documents. These documents lose visibility (and possible tailoring efforts done elsewhere are lost) when categorically imposed in this manner. It is usually more effective to specify these documents or specific portions of them directly in the contract.

- Ways to increase the use of commercial products and non-Government standards which will satisfy Government requirements should be an important consideration during document preparation or revision. Efforts to identify possibilities, encourage their use, or reduce impediments to their use should be reflected in standardization document contents.

- Specifying acceptable quality levels (AQL) as firm military specification requirements inhibits quality improvement and precludes competition based on excellence. Such specification requirements imply that defects are allowable and institutionalize the process of accepting nonconforming materiel. Such requirements need to be purged from our specifications and recognized as the province of contract administration. In a similar vein, the introduction of

Quality Assurance Provisions (QAP) onto the drawings virtually immobilizes the contractor's opportunities to improve his acceptance processes. Specific values for AQLs and lot tolerance percent defective (LTPD) are no longer to be included as requirements in military specifications.

- Specification requirements define the performance and physical characteristics of a product for the purpose of acquisition. Inspections and tests are included to ensure uniform methods for verification or compliance with specification requirements. Sampling inspection procedures are valuable tools and are acceptable for verification of contract requirements. Acceptance of products other than fully compliant with military specification requirements is an administrative and contractual matter and is not properly a part of a military specification.

3.5 SOME REASONS FOR "HOW TO" SPECIFICATIONS

Even though the above policies exists for the preparation of specifications, there is a strong tendency for technical activities to specify their needs in very detailed "how to" terms. The reasons for this situation are numerous, some of which are noted below:

- Belief that Government technical personnel know the user requirement better than any suppliers who have vested interests in selling their products.

- A perception that risk of failure will be lowered by a detailed specification and TDP.

- Concern with interchangeability and to ensure that a known, standard product is obtained.

- Perceived difficulties in evaluating perhaps very diverse contending products against a performance specification.

- Lack of trust of contractors and a belief that any technical change for improvement involves unacceptable risks.

- A concern that users could become too reliant on suppliers designing the product they really need.

- A perception that it would be inappropriate to develop closer buyer/seller relationships.

- A preference for known Government procedures and a belief that only these procedures minimize risk.

- Lack of expertise by the user, who finds it faster and easier to "cut and paste known product specifications than to define performance requirements.

- Ignorance of the potential benefits from using performance specifications.

- A lack of adequate guidelines on the preparation of performance specifications.

- A fear by Government employees that eliminating preparation of how to requirements will eliminate their jobs.

These perceptions and beliefs highlight the need for greater interaction between users, when specifying their needs, and expert buyers who can often suggest less costly and equally effective ways of satisfying those needs.

3.6 COST CONSIDERATIONS

It is in the definition of a requirement that considerable economies can be made. Specification writers in the past have been too little concerned with cost cutting, or the cost ramifications of the specifications they write. For example, the wrong type of specification can result in significant cost being incurred to evaluate proposed solutions. These costs can, and often do, represent a significant proportion of total project costs, and are particularly prevalent in high-technology areas.

3.7 MANDATE FOR CHANGE

The primary change necessary is one of emphasis, from predominant use of detail technical and fabrication specifications to a greater use of and reliance on, performance specifications. Current policies already prescribe the use of performance specifications, but there is an apparent unwillingness to use them. A change in emphasis will benefit users, the DOD and suppliers. Users will benefit from having new technologies and capabilities available to them through increased competition; the DOD will benefit from increased competition bringing reduced purchasing costs; and suppliers will benefit from having greater access to Government purchasing.

This focus on performance specifications is not, of itself, the answer to the problems cited in Section 3.3. Rather, the solution lies in the use of performance specifications as a part of the overall procurement process of the Government. The use of performance specifications in the contractual process is addressed in the following chapters.

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CHAPTER 4

DEFINING PERFORMANCE REQUIREMENTS

4.1 INTRODUCTION

Because the user are the ultimate beneficiaries of any procurement, it's both reasonable and appropriate that they define the requirements for the procurement in the form of a (user) specification. Historically, the user has defined system requirements through use of a Materiel Need (MN), a Required Operational Capability (ROC), a Joint Statement of Operational Requirements (JSOR), Operational Requirement Document (ORD), or other similar document, which is then translated into a procurement specification by the acquisition agency within the DOD.

The foundation of a good user requirements document must be laid in the planning and analysis undertaken before writing ever begins. Both the planning and the analysis take time, and involve large numbers of personnel external to the user or requirements development communities. However, a cohesive planning and analysis effort will provide a better forum for a comprehensive understanding of the requirements, and may also reveal some alternative solutions.

This planning and analysis activity is particularly important when developing complex requirements for a major system. Historically, it may take some time to define system requirements, perhaps even years in the case of major systems. However, the accuracy and detail of the definition is likely to improve as information is gathered and assimilated. Identifying and exploring potential solutions as a part of this process allows the user to refine needs, think in terms of the minimum performance required or the essential functions to be performed, and consider the benefits of all potential solutions.

Breaking down the requirement into its components and subrequirement allows better definition of the requirement in terms of both function and performance. Defining the requirement in terms of the lowest level functions which must be incorporated should also help identify conflicts and inconsistencies within the evolving requirements. Alternative solutions may also be revealed in the process. In that regard, potential bidders should be given the opportunity to offer alternative solutions - but they can only do so if the user's requirements are defined, and not the characteristics of a presupposed solution. This latter approach is often followed, even if inadvertently, when the need is identified in terms of the characteristics or shortfalls of an already known product. In this vein, the offerors should be encouraged wherever possible to visit with the user, and propose potential solutions on a commercial basis.

Within the developing specification, only those aspects of the requirement which are essential to providing the customer with a viable and practical solution should be specifically identified. Optional "extras" which are desirable or "nice to have" may be identified in the RFP as precisely that, and the evaluation criteria should so recognize this condition. The amount of detail in the definition of requirements should reflect the complexity and importance of the significant requirements.

One other consideration should be addressed here: there is frequently a tendency to define user requirements - and then make changes after contract award. Once the requirements have been fully defined, they must be frozen. If they aren't, an acquisition strategy using performance specifications will offer little improvement over the current environment. In those cases where the user can't freeze some specific requirements, the initial precontractual discussions as well as the RFP must identify these areas and bound them.

4.2 DEVELOPING PERFORMANCE REQUIREMENTS

Performance specifications reflect the outgrowth of the user's requirements as defined above. As such, they must expand upon the user's requirements to express them in terms of characteristics against which prospective offerors can propose. In doing so, they also provide the measurement points against which the prospective offerors will bid (or decide not to do so!).

For a new system, these characteristics are best described as being functional or performance-related in nature:

- Functional characteristics are used to define results; in doing so, they define the task or desired result by focusing on what is to be achieved; they do not describe the method of achieving the intended result.

- Performance characteristics are a logical extension of functional ones. They define the required performance parameters of the user by identifying details of operating inputs and outputs. In an analogous manner to functional characteristics, they do not state how this performance will be achieved by the contractor.

The preceding discussion is most applicable to new items under development by the Government. While they are also applicable to procurement of items (systems or parts) already in the inventory, such items are also guided by other characteristics. For example, many such items may be driven by technical or logistics considerations already defined for the similar items now in the field.

Many requirements can be defined relatively easily, and can be readily satisfied by commercially-available products. For such items, developing a detailed specification is uneconomical, and such requirements should be defined simply in terms of function and performance.

The specifications must provide both the Government and the contractor with a means of measuring compliance with the specification requirements. For example, if the user states that the item "must fit securely," the contractor needs to know "how securely is good enough," and the customer must define (in advance!) a finite means by which the secureness of fit will be measured.

During the development of the system requirements and the ensuing specification the customer may decide to incorporate additional technical features as it is refined. There is nothing wrong with this approach, as long as the technical characteristics which evolve are the best way to define the user's true needs.

However, once the customer defines the requirement in technical terms, these may be difficult to modify after contractor selection and contract award if the requirements change or are corrected to recognize some shortfall which was not identified earlier, since the contractor is only supplying what was initially specified. For this reason, the DOD must clearly identify all operational requirements which are felt to be of significance.

In addition to performance specifications for the end-item hardware or system, there must be similar requirements for the system support activities. This could include such elements as system software, system support hardware and software, all elements of logistics support, and training/training equipment. These activities must reflect the requirements of the user, as well as the DOD's long-term concept for employment and support of the item, since these have direct bearing on an offeror's approach to meeting the customer's needs. For example, the offeror should, under current DOD support concepts, develop a design approach which maximizes maintenance at forward levels. If the user specifies a requirement for totally organic support, however, LORAs may drive the offeror toward a large number of non-repairable elements to minimize Operating and Support (O&S) costs, whereas a Contractor Logistics Support approach might be less costly to the DOD if recognized in the requirements development.

4.3 ACQUISITION STRATEGY

There are three primary methods by which the Government can use performance specifications to procure items from its contractor base:

- Procurement of items which are being developed for the Government to meet specific needs for which no readily-available commercial item is satisfactory.

- Reprocurement of hardware for systems which are already fielded where a performance specification is used for the first time. In such situations, the current TDP becomes the informational basis from which potential offerors start. This situation requires the procuring activity to clearly enunciate the user's needs in the requirements documents, and eliminate all those which do not add value to the final product required by the customer.

- Procurement of NDI to meet a user's defined need. While engineering effort clearly may exist in this instance, its cost is usually borne by the potential contractor. This approach is (or should be) little different from that of a commercial endeavor, wherein the offerors propose designs which meet the user's stated critical needs, offer improvements in some areas above the minimum essential requirements, and provide the Best Value to the customer.

In today's environment of declining defense program initiations, new starts of items will consume a more limited share of DOD procurements. For this reason, the most obvious applications of performance specifications will be in the second and third areas cited above.

4.4 EXAMPLE - "SIGNAL CORPS SPECIFICATION NO. 486"

A good example of a performance specification of an NDI procurement, and one which has been used on many prior occasions as model of how the Government should buy hardware, is the original RFP for the procurement of the first "aeroplane" by the Army Signal Corps. The RFP ("Signal Corps Specification No. 486") was a mixture of performance and functional characteristics, tender clauses and contractual conditions, which also included testing and acceptance procedures. It was just a few pages long, but identified the issues of major importance to the buyer. The Wright Brothers won the contract, which was let about 2 months after the RFP was announced, at a cost of $25,000. The actual announcement for Specification No. 486 is at appendix C-1, with underlining added for emphasis.

Some comments on Specification No. 486 are still appropriate for performance contracts in today's environment nearly 85 years later:

- There were specific requirements defined:

- A "flying machine supported entirely by the dynamic reaction of the atmosphere and having no gas bag."

- The capability to "carry two persons having a combined weight of about 350 pounds, also sufficient fuel for a flight of 125 miles."

- "A speed of at least forty miles per hour in still air."

- That the offeror state "the time which will be required for delivery after receipt of order" - the schedule.

- The acceptance criteria were also clearly identified:

    - "Only after a successful trial flight, during which it will comply with all requirements of this specification."

    - "The speed accomplished during the trial flight will be determined by taking an average of the time over a measured course of more than five miles, against and with the wind. The time will be taken by a flying start, passing the starting point at full speed at both ends of the course."

    - "A trial endurance flight will be required of at least one hour during which time the flying machine must remain continuously in the air without landing. It shall return to the starting point and land without any damage that would prevent it immediately starting upon another flight. During this trial flight of one hour it must be steered in all directions without difficulty and at all times under perfect control and equilibrium."

    - "Three trials will be allowed for speed... Three trials for endurance... and both tests must be completed within a period of thirty days from the date of delivery."

    - Penalties for failures to comply with the speed requirements were also clearly spelled out.

- Informational data were clearly identified as such:
  - "Drawings to scale showing the general dimensions and shape."
  - Statements of the speed for which it is designed...the total surface area of the supporting planes (and)...the total weight," along with a "descriptions of the engine" and the "material from which the frames, planes and propeller will be constructed."

However, the seeds of uncertainty and contracting peril were also contained in this RFP, ones the DOD is still struggling with today. For example, the RFP stated that the flying machine "should be capable" of being assembled and put in operating condition in about one hour; of operating in "any country which may be encountered in field service;" of being operated by "an intelligent man" in a "reasonable period of time;" and a few others. In some ways, the RFP was a precursor of today's environment: although the penalties are not so specific today, the major performance requirements are usually well-defined - but both the contractors and the Government expend a significant amount of time wrestling with compliance issues on the open-ended items where we may not have adequate definition of either the characteristics or their relative importance.

4.5 LEVEL OF SPECIFICATION DEVELOPMENT AND CONTROL

One of the largest areas of confusion or uncertainty on the part of specification writers revolves around the question of "how low should I go?" in the development of performance specifications - "to what level do I control the hardware?" Each case will be different, but the guiding rule is that the characteristics of the item should be definable by its functional performance characteristics on its own. For example, it should be possible to write a performance specification for an engine that powers a tank or a helicopter; it should also be possible to write a performance specification for the shaft that connects the engine to the rest of its appropriate vehicle, since it can be defined in terms of dimensional envelope, power transmission requirements, endurance or fatigue life, interfaces, and so forth. Many of these interfaces are easily identified, since the prime contractor today is buying the item to a performance specification. Examples of this latter category would include such things as landing gear or an auxiliary power unit (APU) for that helicopter; the helicopter manufacturer defines what is needed to meet the system performance requirements, and the subcontractor with the specific landing gear or APU expertise designs and develops the item. In fact, the DOD is in the same situation (although its engine contractor isn't), because the engine is being provided as Government Furnished Equipment (GFE) to the vehicle contractor against a defined interface - a performance specification as far as the system contractor is concerned.

In summary, the Government must define its needs at the highest possible level, and flow these down to that level at which it can define the desired performance in clear and unambiguous terms (see figure 4-1). The contractor, on the other hand, must take these requirements, "flesh them out" to complete the design and fabrication of an item which will meet the customer's stated requirements; to do so, the contractor must exercise control at the lowest possible level. Unlike today's environment, where that control at the lowest level is influenced, controlled, and/or actually verified by the Government, this lowest-level control clearly becomes a contractor responsibility under a performance-based acquisition approach, and the adequacy of the product is defined by its ability to meet the requirements of the performance specification.

Two examples of this approach are contained in appendixes C-2 and C-3. The first of these is generic in nature, and depicts a theoretical space communications system, and the levels at which both the prime contractor and the ultimate customer exercise control over the system. The second example uses the Army's M109A6 Paladin self-propelled howitzer system to illustrate how a performance specification - in fact, an entire series of performance specifications - could be used in the acquisition process.

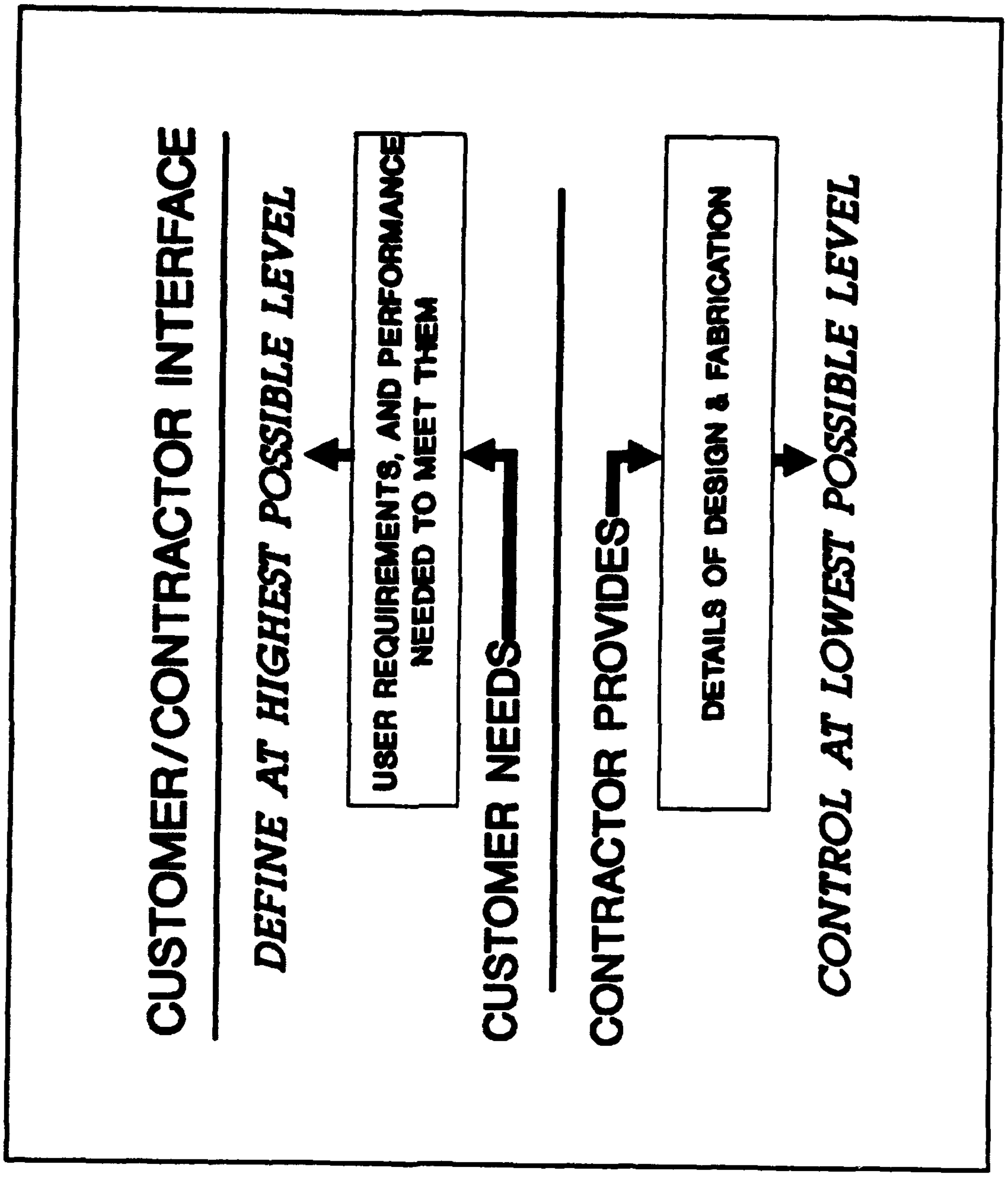

Figure 4-1 Customer/Contractor Interface

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CHAPTER 5

DEVELOPING PERFORMANCE SPECIFICATIONS

5.1 INTRODUCTION

Development of a specification should be seen as an evolutionary process involving close and continuous liaison between the user, the specification writer and procurement staff. Before a specification is finalized, it may progress through several drafts with input from many sources. Development may be concurrent with staged procurement activities, or it may be completed before any approach is made to potential suppliers.

5.2 STRUCTURE OF SPECIFICATIONS

Specific instructions for the classification and preparation of specifications are clearly provided for in DOD instructions. MIL-STD-490A classifies the types of specifications as follows:

Type A - System/Segment Specification.

Type B - Development Specification.

Type C - Product Specification.

Type D - Process Specification.

Type E - Material Specification.

Product specifications are of primary interest when specifications are being developed for the acquisition of defense products. Broadly speaking, product specifications can be divided into two types:

- <u>Performance</u> Those which define the complete performance required of the product for the intended use and necessary interface and interchangeability characteristics. It covers form, fit and function. Complete performance requirements include all essential functional requirements under service environmental conditions or conditions simulating the service environment.

- <u>Fabrication</u> Those which define the detail technical and physical description of the parts and assemblies of the product in terms of physical dimensions, materials, manufacturing processes, etc. Fabrication requirements usually prescribe compliance with a set of drawing and corresponding inspections to assure proper fabrication, adjustment, and assembly techniques.

In commercial practice, performance specifications are preferred and provide many benefits:

- Encourage alternative and innovative solutions.
- Reduce resources required by offerers to prepare detailed responses.
- Minimize resources and effort to prepare the specification.
- Minimize the impact of suppliers' marketing pressures.
- Focus on results, not fabrication characteristics.
- Allow modification of design for parts obsolescence/unavailability.
- Allow use of Environmental Best Management Practices.

5.3 PERFORMANCE SPECIFICATION EXAMPLE

A one-page example of commercial performance requirements is shown in figure 5-1. Note that corresponding Government specifications for items essentially identical to this specification are over 40 pages in length!

POWER SUPPLY

- Adjustable Microchannel Plate Voltage with External 250K Pot
- Bright Source Protection and Automatic Brightness Control
- Proposed Size 1 ½" x ½" Maximum

PARAMETER	NAME	UNITS	MIN	NOM	MAX
Input Voltage	B+	+VDC	3.2		6.2
Input Current	Iin	mADC	-	10.0	35.0
Cathode Supply	V1	-VDC	-	200	-
BSP Resistor	Z_o	GΩ	1.0	-	5.0
Cathode Clamp @ 1M	V1	-VDC	1.0	1.6	3.0
MCP-In Supply*	V2	-VDC	700	-	1400
MCP-Out Supply	V4	VDC	0	0	0
ABC Spread	dI3	nADC	0	4	$50I_F$
ABC Finish	I3F	nADC	-	65	-
Anode Supply	V3	+KVDC	-	5.5	-
Temp. Operation	T_o	° C	-40	-	+40"
MCP-In Load	RL	MΩ	120	-	1300
Humidity			0%		95%
Storage Temp.	T_s	° C	-40(goal)		+72

* External Gain Adjust Pot

Figure 5-1 Specification for a Low-Cost Commercial Power Supply

A discussion and sample for the format of a Product Performance Specification is included as appendix D to this pamphlet. In addition, a specific comparison between performance-based and TDP-based specifications is provided in appendix E. Appendix E-1 contains a section-by-section comparison between a performance specification for a company-developed system and the old, TDP-based approach; the performance specification itself is included as appendix E-2, and a section-by-section comparison of page count between the two approaches is at appendix E-3, respectively. Note that the sample performance specification in appendix E-2 has been reduced significantly in its level of detailed requirements, but still holds the contractor responsible for the performance, reliability, and interchangeability of the item while providing the same performance of the item under a TDP-based procurement. In addition, language such as the following should be included in the contractual documentation for the procurement, to ensure environmental and safety compliance:

"All Materials and Processes used in the Performance/Product Specification shall be consistent with Environmental Best Management Practices, and comply with all Federal environmental, health, and safety regulations."

5.4 EXCLUDING UNNECESSARY INFORMATION

Excluding unnecessary information is as important to preparing an effective specification as is including relevant information. The procurement staff requires information to prepare contract documents. You may consider that some of this information should be included in the specification as well as, or instead of, these documents. Conversely, the procurement staff may consider that some of the detail in the specification is more appropriately included in other contract documents.

Early discussion of your requirement with procurement staff should minimize these problems: agree with them what goes in the specification and what does not. Where uncertainties arise discuss them with procurement staff and be guided by their expertise. Information which would normally be excluded from a specification include--

- Reference to price (unless the specification requires "design to cost").
- Any requirements which conflict with product environmental, health, or safety standards.
- Contract management requirements, e.g., project management, program reviews, meetings.
- All matters of a contractual or legal nature, e.g., closing date for offers, cost escalation factors, warranty.
- Delivery schedules.
- Payment (milestone) schedules.
- Project management obligations of each party (unless these are part of the requirement).
- Ownership aspects of Intellectual Property Rights, Patents, etc., in products provided or developed under the specification and contract.
- A pro forma questionnaire or other document for offerers to complete with details of the product offered, including financial, functional, performance and technical characteristics.
- Schedules necessary to perform life cycle cost analysis.
- A statement of the acceptability of partial or alternative offers.
- A Statement of Compliance with the conditions of the offer, contract, and specification to be completed by offerers.
- Evaluation criteria and method.

- Contact names and phone numbers for further information on the request for offers and specification.
- A list of departmental authorities responsible for different aspects of the procurement, e.g., Design Authority, Paying Authority.
- Arrangements for gaining approval to undertake work under the contract.
- General security aspects of the purchase including procedures for managing security.
- Aspects of the requirement listed as evaluation criteria in determining best value.
- Timing of possible equipment or software upgrades and necessary details of the different upgrade options.
- Requirements and information from offerers on the Quality System.
- Arrangements for testing and monitoring quality of the offered products.

CHAPTER 6

USE OF PERFORMANCE SPECIFICATIONS IN ACQUISITION

6.1 INTRODUCTION

Although the purpose of this document is oriented toward the use of performance specifications, this course of action requires a wider field of view than just the specification itself. Rather, it must include the means by which the Government uses the performance specification to procure deliverable products; that is, it must encompass the contractual considerations necessary to implement the concept of performance specifications. The acquisition strategy can combine the use of Product Performance Specifications with Best Value source selection to achieve increased product quality at reduced cost. This strategy is only "new" from the standpoint that it consciously links the proven techniques of Best Value with the use of performance specifications to achieve increased benefits. The combining of Best Value source selection techniques with the use of product performance specifications into an acquisition strategy offers significant advantages to both industry and the Government.

This section of the Guide provides an overview of a performance-based acquisition approach; definitions and principles embodied in the approach; discussion of benefits to be derived through this approach; issues; and, of equal importance, exceptions to the approach - cases where performance specifications may not be the most desirable approach.

6.2 ACQUISITION STRATEGY APPROACH

The Government would buy materiel to performance specifications, as was shown graphically in figure 1-2. In order to do this, the performance requirements would have to be clearly defined and articulated in the specification and mirrored in the RFP issued to industry. In meeting the requirements of the contract, the selected offeror would use the existing TDP for information - essentially, how the materiel is being produced today (for items already in production).

Even in the proposal stages, before the contractor had received the award, the customer would have to identify the added value "targets of opportunity" discussed earlier. The offeror would have to show that the additional benefits to be derived from these above-minimum requirements were worth the added cost to obtain them. In addition, the offeror would be free to eliminate any non-value-added requirements that still remained in the specification, as long as their elimination did not degrade the needs identified in the performance specification.

The Government would then accept contractor deliverables on a Certificate of Conformance (COC), with a strong applicable warranty. It is intended that the Government could waive First Article Test (FAT) or qualification test requirements, particularly for contractors who were certified (reference the earlier discussion on CPI and AMC-P 715-16), or who had previously qualified the product. The Government would use process capability and performance assessments derived from the CPI methodology to reduce or eliminate acceptance inspection requirements. In order to implement such an approach, Contractor Performance must be a consideration in the source selection process leading to a Best Value selection, as well as an evaluation of the contractor's implementation and/or status in a continuous process and product improvement effort.

6.3 PRINCIPLES

Certain key principles control contractual actions and activities. They include the following:

- The Government's essential requirements are defined on the basis of performance characteristics - a performance specification - rather than detailed TDPs. These performance specifications are the top-level item identification, and take precedence over drawing packages, which would generally be provided as advisory only.

- The performance specifications can be supplemented with drawings and process control specifications, if such items are needed to fully define the item being procured by the Government.

- The applicability of performance specifications must be addressed in all acquisition strategies and acquisition plans.

- The performance specifications clearly articulate the user's requirements. It goes without saying, therefore, that the user must play a key role in the development of the performance specification.

- Since the Government has now identified what it wishes to buy by describing its performance requirements, it must create a favorable environment, in which acquisition strategies and solicitations challenge and eliminate added functional requirements which add no value to the final product. Specifications and standards, inspection and testing requirements, data, and Government oversight must reflect minimum essential needs.

- In addition, the solicitations should identify added value "targets of opportunity" for industry to pursue. As noted above, this leads to Government acquisition of products from industry on a Best Value basis using performance characteristics as identified in the performance specification.

- As a key part of the Best Value process, contractor past performance must be a consideration in all source selection processes.

- As long as the performance specification remains unchanged, configuration management and control is vested in the contractor. The DOD must retain the right to buy spares/repair parts using the contractor's drawing package. Such an approach can maintain compliance with competition requirements.

- The contractor will maintain and warrant the TDP, including the fact that he built the hardware from the TDP. The Government may have the opportunity to exercise options to acquire the TDP, if necessary, and/or to procure spares and repair parts against the same criteria under which the contractor is procuring or producing hardware.

- The Government will accept products on Certificates of Conformance (COC) to the maximum extent practicable, rather than using detailed inspection and acceptance procedures.

6.4 EXCEPTIONS

While performance specifications can offer significant benefits to the overall acquisition process, there will be numerous situations when they should not be the recommended approach for Government acquisition. While it is a highly effective technique, use of performance specifications can not be applied on a cost-effective basis to all procurement actions and product acquisitions. Some of the readily apparent occasions would include--

- Service contracts, or situations in which the Government must maintain some level of guidance and control over the activities performed. Alternatively, it may not be possible (at least initially) to quantitatively define the exact products/services to be delivered, and gradations of value above that minimum level of performance.

- Materials (e.g., sheet steel), where the hardware in question is already defined by a specific set of commercial requirements, and is usually available on the commercial market that way.

- Low-dollar spare parts, for which dimensional requirements are already in existence and there is no simple means to define the part in terms of a measured performance. For example, an engine or its drive shaft could be defined by a performance specification, whereas an filler cap for the engine might be described most easily by its dimensions.

- Construction, for somewhat the same reasons as cited above.

- Small purchases, for which the effort of defining a performance specification would outweigh the cost of continuing today's procurement approach.

- Procurements where a performance specification is not cost-effective, or its use is clearly not in the Government's best interest.

6.5 SMALL-DOLLAR ITEMS

One might argue that it is not cost-effective to use performance specifications for small-dollar purchases (e.g., small purchases to support fielded systems), since the TDPs already exist, and are being used today for reprocurement activities. In this case, the questions then become--

- Is it possible to define the part by means of a performance specification? If it is possible:

  - From a cost effectiveness standpoint:

    - How much does the Government spend today, to maintain the data package and inspect/accept the hardware against it?
    - How much would it cost to transform the specification into a performance specification?
    - For how many years will the item remain in the inventory, to recoup any costs for conversion?

  - Will there be any impact on the logistics support for the end-item?
  - How will configuration control be maintained?

- If it's not possible to define the part in terms of a performance specification, how can this effort be performed at a higher level on the system? If so, give consideration to the same questions outlined above.

In nearly all instances, the answers to these questions will show that a transition to performance specifications would increase costs. For example, the Government would have to write the performance specs; the potential offerors would be forced to have engineering capability in order to transform it into a specification against which they could build the hardware; and all proposals for such items would have to be evaluated by the Government - a source selection, and not the response to an Invitation for Bid.

6.6 PERFORMANCE SPECIFICATION ISSUES

Note that the real impacts in the transition from a TDP-driven procurement to one based on a performance specification fall primarily in the quality, logistics, and configuration management areas, which in turn reflect back to the procurement community. For example--

- If the Government is now buying piece parts to support a system or subsystem in the field using organic forces, how does the customer continue to buy these parts with a higher-level performance specification - or does it?

- How can the Government ensure that the piece parts will continue to work, and not become obsolete due to lower-level contractor changes, if the customer no longer controls their design?

- How will the Government verify the functionality of items procured from new contractors before they are installed in higher-level assemblies?

- How and when does the Government transition control of the TDP to the contractor, then subsequently re-acquire the drawing package to issue it (for information only) when a competitive reprocurement of the item is to occur?

- How are testing and acceptance requirements incorporated into the Best Value procurement, to ensure that such efforts, if any, are essential and add value to the end-item procurement?

Resolution of these issues begins with the definition of the user's requirements and follows the process through Government acceptance. Resolution must also address the Government's remedies in the case of nonperformance by the contractor under a performance specification strategy - and how essential it is to ensure that the mechanism for these remedies is in place before the contract is signed. Suffice to say here that it depends on the Government's clear definition of the user's needs in the performance specification; control of the form, fit, function, interface(s), and interchangeability of the item in the field.

The primary emphasis, however, is that a performance specification approach to acquisition represents a transition from today's "built-to-print" environment. It requires identification of essential requirements for the item, along with areas where improvements might be desired. It places the requirement for potential improvements, including any design and development effort, squarely on the offerors, and states that such improvements will be evaluated as part of the Best Value source selection. As a result, the performance-based acquisition isn't just a process for the continuing reprocurement of the same item. It offers the Government the opportunity to capitalize on the technical expertise and ability of the industrial community, such that the Government can procure products at continually improving levels of performance and reliability.

6.7 SOLICITATION EXAMPLE

The following example is based on pertinent portions of such a recent solicitation utilizing performance requirements and Best Value.

SOLICITATION 92-XXXX-12345

EXECUTIVE SUMMARY

The solicitation is structured to utilize the best value concept. Award will be made to the best overall proposal which is determined to be the most beneficial to the Government. The solicitation provides a list of examples of performance enhancements as part of the technical statement of work. Offerors are given latitude to propose the current system or any enhancements. Enhancements proposed which exceed the minimum requirements, are determined to be beneficial to the Government and result in improved performance, improved reliability, reduced size and weight, etc., will be evaluated. **Drawings are provided for information purposes only.** As a minimum, offerors shall meet all requirements of the statements of work (SOW) in order to be acceptable.

TECHNICAL STATEMENT OF WORK (SOW)

Scope This SOW outlines the technical requirements. **The referenced specification is provided for informational purposes** with the required paragraphs called out in this SOW. The contractor's qualified product shall meet all proposed operational and functional requirements. **All testing procedures called out in the military specification are for information only.** The contractor's proposal shall set forth the testing used to qualify the proposed product following award. A list of value-added enhancements in which the Government is interested is provided as an Addendum #1 to this SOW.

General Requirements Reference MIL-SPEC-XXX. (Note: This paragraph provides a description of the product and its intended use.)

System Requirements The system requirements defined in 3.5 through 3.8 of MIL-SPEC-XXX are the minimum requirements. All references to drawings in this specification are for information only.

Interchangeability/Interoperability The product shall be interchangeable and interoperable with all previous systems and repair parts to the Line Replaceable

Unit (LRU) level. The product shall not exceed the volumetric size of 5 X 5 X 10 inches (250 cu.in.) nor a weight of 10 pounds.

Environmental Requirements Paragraphs 3.9 through 3.14 of MIL-SPEC-XXX define the environmental requirements.

Configuration Requirements Configuration control shall be maintained throughout the Contract per the Configuration Management SOW. In the event that the proposed product deviates from the MIL-SPEC-XXX product in form, fit, or function, the contractor requirements shall be applicable to the extent they meet the minimum requirements above.

Logistics Requirements The contractor shall update all provisioning master records and manuals to incorporate changes required as a result of Best Value enhancements. In the event that the proposed product deviates in the areas of form, fit and function, the contractor is required to meet the Integrated Logistics Support SOW.

Definitions

Form, Fit, and Function For the purposes of this contract, form fit, and function shall define the physical, functional, and performance characteristics of the product.

FOLLOW-ON TEST AND EVALUATION (FOT&E)

Products which are determined by the Government to meet the above requirements shall be required to successfully complete a FOT&E prior to delivery. The contractor shall be required to correct all deficiencies identified during the FOT&E at no cost to the Government. The FOT&E shall be performed per the FOT&E Design Plan.

BASIS FOR AWARD

An award will be made based on the best overall (i.e., **BEST VALUE**) proposal that is determined to be the most beneficial to the Government, with appropriate consideration given to the three (3) major evaluation factors, engineering approach, price, and product assurance/program management. The engineering approach factor is significantly more important than either of the other factors, price and product assurance/ program management are equal in importance. *To receive consideration or award, a rating of no less than* "acceptable" must be achieved for each of the overall factors other than price. Past performance will be separately evaluated to assist in determining overall performance risk. Offerors are cautioned that award may not necessarily be made to the lowest priced offeror.

ADDENDUM #1 TO THE TECHNICAL SOW

EXAMPLES

The following are examples of items which the Government considers Potential Value-Added Enhancements. These are only examples and are not intended to be all inclusive. Offerors who propose a system which meets the minimum requirements of this solicitation shall be acceptable.

1. Increased range.
2. Improved accuracy.
3. Reduced weight.
4. Reduced size.
5. Improved reliability.
6. A design to allow mounting/operation with the following systems...
7. Interchangeability at the same spare part level.
8. Reduction in unique spare parts.
9. Reduction in hazardous materials (HAZMAT).
10. Simplified operational and maintenance procedures.

CHAPTER 7

CONFIGURATION AND LOGISTICS MANAGEMENT IMPLICATIONS

7.1 INTRODUCTION

Management controls constitute one of the areas where the Government maintains control over the acquisition process, and, by doing so, inhibits the ability of the Government to acquire the best product at the best price. Two such areas, as noted earlier, are those of Configuration Management and Logistics Support. The following sections address how each of these could be treated to ensure that the Government retains overall control of the acquisition process without encumbering the offerors by doing so.

7.2 CONFIGURATION MANAGEMENT AND CONTROL

Historically, the Government's Configuration Management (CM) approach has usually involved a gradual assumption of overall CM authority during development of a system as the development program progressed. That is, the contractor was given a fair degree of latitude to effect changes in the system design approach; the Government maintained oversight, but no stringent review and approval cycle except for major alterations to the originally-approved design. As the system design approached the end of development, however, the Government assumed more and more control over the developer's ability to make changes, such that the contractor's ability to implement proposed changes to meet performance requirements was steadily diminished. Finally (usually at some point between the Functional and Physical Configuration Audits - FCA/PCA), the Government would assume full control of the design (as represented by the drawing package); the contractor, who used his expertise to design and develop the system, now had no control over it, nor any ability to change it without an often time-consuming process filled with multiple internal and external approval levels.

With the development of acquisition initiatives within the DOD, a key issue is removal of the barriers between commercial and Government procurements. To this end, commercial standards should be implemented within procurement specifications to the maximum extent possible, rather than continued reliance on MIL-Specs and standards. The military-peculiar systems were initiated when there were few commercial systems with the specificity or control required by the services. Today, however, commercial standards in many areas are more widespread, consistent, and stringent than their military counterparts, and facilitate both interface and dialogue between the military and commercial communities.

The basic question which each acquisition manager must ask is whether, and why, the Government must take over the responsibility for the drawing package at all, if the primary requirement is for the performance of the system in the field. Several concerns have been raised in this area, most of them closely related to the logistics management area discussed in the following section. Some of these issues include--

- Overall control and identification of the configuration for the system, to include issues of interchangeability, functional interoperability, and changes.
- System configuration audits and status accounting, to ensure that the user knows how the systems in the field are in fact configured.
- Logistics support for the system in the field, including spares, training, and manuals. This would also include the risk of obsolescence caused by design changes.

Although the issues are so interlocked, the last item above will be addressed in greater detail as part of a discussion of logistics issues in a subsequent section. However, the remaining CM issues above can be addressed as part of a performance based contracting approach to meet Government requirements.

7.2.1 CONFIGURATION CONTROL

Independent of where, how, and by whom the configuration is managed, there must be a single point of such control, whether contractor or Government (the Government at the specification level (and its external interfaces, if any) and the contractor below that level). Obviously, this single point constitutes the "source document" point for the system. In today's environment, this control is maintained by the Government in nearly all cases, through one of three primary means:

- In-house control of the TDP by the Government, with minimal contractor involvement. This is most frequently the case for systems which are out of production, and for which the primary requirement is for spare parts to support the fielded system.

- In-house control of the TDP by the Government, with a significant amount of contractor involvement. This is often the case for systems which are still in production today, by the original developer and/or by a new end-item system source.

- Maintenance of the TDP by the contractor, with some level of guidance and control by the Government. This control may be minimal for items which are virtually "off-the-shelf" procurements, or may be quite extensive for items which have evolved through a development program. Obviously, this latter case is most frequently seen in today's environment for NDIs, with most other procurement fitting one of the first two cases above.

In addition, a subset to each of these three cases is one in which the Government contracts with a third party (neither the manufacturing contractor nor an in-house organization) to provide functional CM support.

The transition to performance specifications should encourage control and maintenance of the design package toward the last of the three approaches above; that is, the contractor would retain control of and responsibility for the system configuration throughout the development and production of the system. However, to ensure that the product continues to meet the requirements for which it was originally defined, visibility into, and control of, "major" changes would continue to reside with the procuring activity. In its simplest form, the "major" changes would be ones that affect such issues as form, fit, function, interchangeability, and interface control of the hardware being procured - that is, affect the performance specification. Since final authority on such issues would probably continue to rest with the procuring activity, a major concern during preparation of the acquisition plan would have to be the establishment of the limits on the contractor's change authority. This concern becomes a more important issue when the Government envisions competitive procurement of the end item during its acquisition cycle.

In light of this concern, it should be recognized that a very strongly-enforced interchangeability requirement and interface control of the system become essential parts of the acquisition process. The Government must, through the definition of the original requirements for the system, identify the level(s) to which interchangeability of hardware must be both maintained and demonstrated by the contractor, since this has very obvious logistics implications. However, anything below that level should clearly be the exclusive purview of the contractor(s).

Note that this freedom for modification below the control level will give the contractor(s) what today would be considered Class 1 Engineering Change Proposal (ECP) change authority for actions below the Configuration Item (CI); in return, however, the Government should expect that improvements in system performance grow from this additional freedom. Associated with this (but somewhat more difficult to quantify, however) is the net cost impact to both the Government and the contractor due to the revised change authority - an issue which seems to stimulate the greatest amount of discussion from both buyer and seller. In both a sole-source and a competitive environment, for example, the Government would argue (and the contractor generally agree) that the analysis to support the potential change must be done by the contractor before the change is proposed for implementation. The only question is the degree to which the role of "the customer as cop" must be contractually implemented, since the time and effort for change proposal preparation, submission, negotiation, and execution (for approved ones) could represent a savings to both contractor and customer (see the discussion in Section 1.2 of this Pamphlet as well).

A major concern, however, particularly in the current environment, is the concept of "cost savings" to the customer for some approved changes. That is, an offeror will frequently discount the proposed price for an effort by assuming incorporation of certain changes for producibility savings - changes that do not affect the performance of the system. However, when the contractor proposes these changes for Government approval after being awarded the competitive contract, the customer seeks compensation in return for approval of the changes - compensation which had already been removed from the proposed price before contract award in order to make that proposed cost more competitive! In a sole-source environment, such changes frequently will not be surfaced by the contractor during negotiations, so that there will be a "real" cost savings which can be identified in the change proposal. In either event, however, the "gestation period" from idea to execution frequently becomes a ready excuse for not implementing the change (this especially applies to Value Engineering ones).

Implementation of a performance-based acquisition approach would directly lead the Government into the last of the CM approaches described above, That is, below some level (which very likely might be the entire system or definable major components of it), the Government would no longer be the "single source" for a drawing package below of the hardware defined by the performance specification. The question then becomes how the Government would be able to procure spares or repair parts for items which utilize organic rather than contractor support (which would clearly be almost all items involved in activities at unit level, regardless of the support concept). The Government would rarely be forced to procure the items from the sole-source contractor because there will be a TDP available. This could be enhanced by be a contractual requirement that the Government have a current drawing package in its possession, updated in a timely manner for any changes, and the right to procure these parts in the competitive market, using the same performance requirements as the prime contractor with his subcontractors. Since the contractor must still show compliance with the requirements of the performance specification using this current drawing package, (unless changes which impact these items are approved by the customer), this would retain a similar level of competition to that which exists today. In other words, if the Government buys parts to the same requirements as the contractor (and ensures that the parts do in fact meet those requirements), the Government has lost none of its opportunities to support the production base, including support for Small/Disadvantaged Business. Issues related to rights in data would be resolved prior to initial contract award. As this could be a critical step in the acquisition process, it should be addressed in the initial planning by the Government, and should be clearly communicated to offerors in the RFP preparation process.

While this delegation of CM responsibility can encourage the contractor to make changes to improve the system, the Government must ensure that such changes do not negate support for systems produced earlier or render obsolete the spares and repair parts already in the support system. To ensure satisfaction of this requirement, the Government must use interchangeability and interoperability criteria as key elements of its customer control, and these must be clearly spelled out as part of the contractual requirements. For example, recently-awarded contracts to dual sources specifically require interchangeability and interoperability with both the current production as well as with production from the previous contracts. The key here is to require this interchangeability at the level at which the system will be supported in the field - by contractor or organic personnel.

In this case, the question becomes one of making changes which do affect the support (and many other) issues, since there very likely will come a time when a potential change offers significant technical improvement and/or cost reduction opportunities, but will breach the contractual requirements. In situations such as these, the proposed change(s) exceed the contractor's CM authority, and would require Government approval prior to implementation - a situation little different from what is in place today. As a result, implementation of such a change would require the support for such a change to be developed by the contractor for Government review and approval, and would represent a conscious decision on the part of the Government to accept the potential impact(s) on support for systems already in the field in order to obtain the identified improvements.

7.2.2 CONFIGURATION AUDIT

In a "typical" program today, there are requirements for both a Functional Configuration Audit (FCA) and a Physical Configuration Audit (PCA) to be performed. Under a performance-based acquisition approach, the Government's primary requirement becomes the performance of the system (does it, in fact, meet the requirements of the specification), and not the "appearance" of the system (which the contractor is free to change as long as the changes do not breach the performance requirements of the specification). As a result, requirements for a PCA may no longer apply, whereas the results of the FCA become a key measure of contractor compliance with the requirements of the performance specification.

If the Government wishes to satisfy itself that the cumulative effect of numerous changes has not degraded the capability of the system to meet its specified performance levels, some type of FCA may be imposed as a part of a production contract; however, this imposition should not be done unless there is concern on the part of the customer that there really is a problem. Obviously, consideration of a FCA is in order when changes are made which modify the performance specification, and which require Government approval before implementation.

7.2.3 CONFIGURATION STATUS ACCOUNTING

Since the contractor is now the sole source for system configuration management and control (short of changes to the performance specification), there must be a system in place that will manage the CIs effectively. In today's environment, this would include the approved CI documentation; the status of proposed and approved changes to that documentation; the status of waivers and deviations; and the configuration of all end items produced under the CI.

In the performance specification environment, the Government would not, as a matter of course, have visibility below the level of the CI, and would have no approval authority in the areas cited above (unless there are changes to the performance specification involved). As a result, it would be in the contractor's best interests to be operating under a system that provides the types of information identified above, but there is no real requirement to do so; that is, the system must able to meet the performance requirements and demonstrate the interchangeability requirements to the level required by the CI.

Herein is the major exchange derived from performance specifications, as identified in nearly all areas of this document: in exchange for giving the contractor greater freedom to deliver a quality product without "excessive" Government control and oversight, the Government receives the guarantee of a quality product; in exchange for receiving that additional freedom, the contractor assumes the added risk and monetary exposure for interchangeability and performance guarantees. Both parties assume some risk, but both parties have significant opportunity for improvement.

7.3 LOGISTICS MANAGEMENT

As noted in the previous section, one of the primary considerations associated with the CM issue is the logistics support for a system in the field. This support includes considerations of maintenance and repair; spares and spare parts support; the support structure (contractor and/or Government) employed; manpower and training implications; and supportability issues for system modifications and changes over time.

Historically, support concept for fielded systems has ranged from a totally organic capability to full contractor logistic support, to include most variations between these extremes. Frequently, however, the approach selected has been driven by available time, technology, and/or available funding levels at the time the logistics support decisions for the system were made or approved. Under a performance-based acquisition approach, most past strategies remain as viable options; however, some of them may become less desirable options than they were before. The following sections discuss some of the considerations which must be addressed in the decision process, as they apply to logistics support concepts. In any event, however, the requirement for timeliness of the basic ·tics support decisions (organic vs. contractor, or some combination of the two) has not changed. The only thing that a performance-based acquisition does is drive these decisions toward the front of the program - which is where they should have been all along, but which, for a variety of reasons, usually have not been.

7.3.1 LOGISTICS SUPPORT ANALYSIS (LSA)

Maintenance planning must be initiated in the early stages of the acquisition process, since it is a key element in the formulation of the maintenance concept. Regardless of the logistics support concept chosen for the system, however, the contractor will have to plan and develop a means to support the system in the field, through some level of LSA. The concept, as noted above, could consider the entire spectrum from fully organic to fully contractor support. The inherent tasks under any of the alternatives, however, must address the same series of tasks, in order to identify and quantify all logistic support goals and criteria, and to quantify the relationships between the support system and the materiel system it will support. As with the approach(es) being employed today, it must address such elements as--

- Actions and support needed to assure that system readiness and supportability objectives will be met, as well as the impact on system Life Cycle Cost for the chosen alternatives. The objectives, obviously, must be clearly defined in the specification.

- Specific criteria for maintenance and repair, to include such elements as testability, built-in and external diagnostics, and manpower/training and facility requirements. This would include MANPRINT considerations.

- Level of Repair Analyses (LORA) to optimize support in terms of the elements cited above.

These analyses, as well as the impact of available time for implementation in some cases, will bound the decision on contractor or organic support, or the transition from one to the other, and the periods for such transitions.

7.3.2 SPARES AND REPAIR PARTS

There are a number of initiatives currently being developed for future implementation, some of which could significantly affect procedures for procurement of spares and repair parts. It goes without saying that the support concepts identified above are all considerations in these initiatives, and must be evaluated as a part of the support concept determination when the Acquisition Plan is developed.

Many of the spares issues will be bounded, if not determined, by resolution of the configuration issues cited earlier. For example--

- At what level will the customer maintain control of the hardware? The system? The subsystem? The LRU?
- At what level will the customer spare and maintain the item (if at all)? If below the CI level, how will the customer buy and use these parts?
- Is there a contractual vehicle by which the Government can both procure current dash-number parts and be assured that their use will not degrade the performance of the system?
- Is there an enforceable warranty that commits the contractor to these contractual provisions, as applicable?

7.3.3 IMPACT OF CHANGES

The area which, historically, has been one of great concern to the logistics community is that of changes to the products being procured; such changes usually requires corresponding changes in the support system for the item. The risk to the DOD is that such changes may quickly obsolete many dollars worth of previously-procured spares and repair parts. At first glance, the probability of such changes might be considered to be high, since the performance specification concept places the CM responsibility with the contractor. To reduce this risk, the performance specification must include a strong requirement for interoperability and interchangeability within it, as noted earlier.

Historically, one of the areas which drives such changes has been the feedback from the user as the result of operational testing of some type. If the changes are indeed due to the inability of the hardware to meet the stated requirements of a performance specification, the responsibility for correction still rests with the contractor, just as it does today. Sometimes, though, the hardware meets the requirements - it's just that the stated requirements don't really identify all of the user's needs (needs that weren't incorporated in the original requirements). To forestall much of this "negative" feedback, the needs of the user must be clearly defined as a part of the original requirements definition. Nonetheless, there may be times during the development process when changes to the performance specification are needed in areas where the user was not specific enough. Obviously, the DOD must minimize such "constructive changes" by clearly defining the requirements initially.

In many performance contracts, though, there will nonetheless be changes which are felt to be necessary or desirable by the customer (just as there are today), and which will impact the current performance specification against which the contractor is developing and/or delivering hardware. These modifications occur through implementation of Engineering Changes, for example to incorporate future technologies and capabilities into the system. We can expect that such changes will continue in the future as, with resources declining, the DOD attempts to extend the service life of major items of equipment.

Each change to the performance specification must be carefully considered by the customer, since it may have significant impact on the entire logistics environment, including such items as spares and repair parts, training, manuals, diagnostic tools, ground support equipment, etc. Obviously, any such change to the performance specification brings the Government back into the approval loop, whether the proposed change is surfaced by the contractor or the Government. Note that even though the contractor has configuration management responsibility, the Government controls the performance specification, and the ramifications of such changes must be carefully considered by the Government before their implementation is authorized.

As noted earlier on several occasions, the majority of situations where this approach would be employed in today's environment of decreasing defense funding, however, are those involving systems which are already fielded, and which represent a transition from a TDP-based contracting approach. Logistics considerations in this area have already been discussed in the Configuration Management section above. The primary requirement in this instance becomes the interchangeability requirement as a part of both the solicitation and the resulting contract.

CHAPTER 8

INSPECTION AND TEST

8.1 INTRODUCTION

Previous chapters discussed the process of establishing the technical requirements that are essential to satisfy customer or user needs. The process of determining which proposal or product best meets those requirements is of equal importance. Technical evaluation criteria are used to determine which offer(s) are technically acceptable. They are combined with other criteria (e.g., price, delivery, past performance warranty) to give an overall assessment of the Best Value to satisfy the specific requirements. Whatever methods are used to define the requirement, the evaluation criteria should be developed in parallel with the requirements section of the specification. From an overall perspective, this evaluation process can be divided into the following five mutually supporting assessment activities:

- Source Selection - to select the best supplier.
- Test and Evaluation - to select the best product.
- Quality Assurance - to verify product conformance.
- Continuous Process Improvement - to improve the industrial base.
- Warranty Provisions - to correct any deficiencies.

Each of these activities contribute to assuring that the specified requirements are addressed. Moreover, each adds cost to the product for some degree of risk reduction that the user requirements will NOT be satisfied. While recognizing the need for test, evaluation and quality assurance, the acquisition plan, the Test and Evaluation Master Plan (TEMP) and quality assurance provisions of the specification should be structured to <u>minimize</u> the added cost.

Performance specifications, in conjunction with Best Value source selection and Continuous Process Improvement, provide the means to reduce the test, evaluation, and quality assurance costs by recognizing that it is the design of the product and the manufacturing process capability and controls within a facility which determine the quality and cost of the product. After the fact inspection always adds cost to the design and manufacturing process. If the product is designed properly and manufactured with adequate process controls, quality assurance requirements should be reduced accordingly. Which companies stay in the defense business is decided every time a contract is signed. In a performance-based acquisition, these qualities must be identified and enumerated in the acquisition strategies and solicitations. If they are, DOD will, *in effect*, be buying not only the immediate product; it will also be defining the industrial base that will support it into the next decade. In this way, performance-based acquisition provides the means to reduce test, evaluation, and product assurance costs based on demonstrated contractor performance. It places the quality responsibility on the contractor through the minimum essential requirements identified, and allows reduction of examination and test based on demonstrated performance. The next several sections of this chapter describe these mutually supportive assessment activities.

8.2 SOURCE SELECTION

Historically, purchases by the Government have tended to be evaluated only on the basis of the lowest price. Other factors such as quality, potential performance, or past performance were often not evaluated, even though long-standing laws and regulations have recognized that Government contracts may be awarded on the basis of price <u>and other factors</u>. A major initiative is to procure systems requirements on the basis of integrated assessments of factors such as price/cost, past performance, quality, producibility, hazardous materials, operational performance, and user satisfaction rather than price alone. This practice has become known as "Best Value," i.e., source selection on the basis of best overall value to the Government.

From a legal standpoint, numerous protests to the General Accounting Office (GAO) and court cases have involved Best Value procurement. The GAO and courts repeatedly have upheld the Government's right to award contracts on the basis of Best Value source selection decisions. To ensure the continued success of such procurements, however, consideration should be given to how an activity cam best avoid the frequent "nuisance" protests by lower bidders who lose Best Value procurements to offerors with superior cost-effective proposals.

Under Best Value source selection evaluations, the Government quantifies the value or worth of individual areas of a contractor's proposal. This quantification may be readily expressed in explicit dollar terms or, as is more often the case, as a risk or benefit assessment of individual proposal areas. Finally, risk/benefit assessments are compared to proposed costs, and the overall merits of the proposal are identified. After comparison of proposals, the Government makes a considered judgement as to which proposal represents the overall Best Value to the Government and will be selected for contract award.

Best Value source selection enables the customer to select the best supplier. Again, the source selection evaluation process should be kept in mind when establishing the test, evaluation, and quality assurance requirements.

8.3 TEST AND EVALUATION

The Government conducts test and evaluation to ensure that systems and end items of equipment meet the performance requirements of the specification. The continuous evaluation approach for test and evaluation should provide feedback to the developer and producer to improve system design and performance. The objective of test and evaluation is risk reduction through integrated evaluation and communication, in a joint industry-Government endeavor during all phases of the acquisition process. Whether for development, production or maintenance, test and evaluation should cover all essential aspects of the technical requirements, and should be designed to demonstrate that the system or end product offered is suitable for its intended purpose. These system-level tests are conducted by Government personnel during development or operational test and evaluations.

National Standards or other industry practices establish standard test methods to verify detail design characteristics and manufacturing processes used in the manufacture of the item, e.g., magnetic particle inspection, soldering, etc. These examinations and tests are the responsibility of, and are performed by, the contractor in order to control the manufacturing processes and to verify conformance to the detail design and technical requirements.

Specifying examinations and tests in specifications must include the criteria for passing or failing those tests, as well as the implications of failing to meet any of these criteria. Criteria for passing the tests as a group (as opposed to passing each test individually) should also be stated. The contractor is responsible for performance of all test in the Quality Assurance provisions of any specification. The Government may verify the results by conducting operational test or having them performed by an independent testing or inspection organization. Arrangements for performing or monitoring tests should be in the solicitation and contract documents, and not in the specification.

The Test and Evaluation process (both Government and contractor conducted tests) is continuous, and large amounts of data and analysis substantiate the performance of defense systems and equipment. This large body of evidence is the foundation of the evaluation process, and should be kept in mind when establishing quality assurance requirements for the evaluation process. Test and evaluation enables the customer to select the best product.

8.4 QUALITY ASSURANCE

Quality is generally defined as "fitness for purpose." Quality is the totality of an item's characteristics which make the item suitable to satisfy the user's needs. In the context of performance-based acquisition, "quality" is a similar concept to "value for money."

Achieving quality begins with the specification: a clear and unambiguous definition of the user's needs gives offerers a good understanding of the purpose of the requirement. From this they can offer a product of such quality as encompasses all the characteristics of the defined needs. Having stated the needs clearly in the specification, the Government must ensure that the required quality will be provided.

For commercial products, the buyer selects the best product based on supplier provided information and independent test results, selects the best source based on past performance and value, accepts the product based on the supplier's certification of conformance, and remedies any deficiencies based on the supplier's warranty provisions. The market place, past performance, and competition provide the test, evaluation, and quality assurance, all at no additional cost to the customer. Additional assurances are available, such as extended warranties. The question that remains is the value of the added costs for the reduction of the risk of NOT receiving a satisfactory product or service. It is the process each of us goes through whenever we purchase an item.

For defense products, the practice has been to require test, examination, and evaluation for each and every requirement (from critical performance requirements to incidental dimensions - at ambient and environmental extremes), all at significant added cost to the product and customers. When the acquisition process has selected the "best" product, the "best" supplier, and the "best" warranty, how much more assurance and inspection is required to reduce the risk of NOT meeting the requirements? The question that remains is the value of the added cost for the added examinations, tests, and evaluation! Today, most specifications continue to require (in Section 4, "Quality Assurance") the test, examination, and evaluation of all technical requirements.

Experience has shown that cost is seldom a consideration in establishing the quality assurance provisions in specifications and TDPs, nor is there a simple means to reduce the quality assurance requirements and their cost once they are established in the TDP. Even when the supplier has demonstrated his process capability and control, the examinations, tests and evaluations continue, based on the sampling plans, AQLs, or 100 percent inspection requirements in the Quality Assurance provisions in the specification and TDP. This represents added costs with little or no value added.

On October 16, 1986, the Assistant Secretary of Defense (ASD) issued a memorandum on "Achieving Continuous Quality Improvement" directing all DOD specification preparing activities to remove requirements for AQLs and LTPDs from specifications. Rationale for this directive was provided in another ASD memorandum on June 16, 1987, which stated in part the following: "Military and federal specifications provide complete descriptions of items acquired by the DOD by defining the technical requirements and appropriate tests and inspections procedures to verify compliance with specification provisions. Military and federal specification requirements that prescribe fixed levels of defects, such as Acceptable Quality Levels (AQLs) and Lot Tolerance Percent Defective (LTPDs), inhibit quality improvements and effective competition based on excellence." After referencing previous memoranda on the same subject, the ASD stated in a February 21, 1989 memorandum to the Services and Defense Logistics Agency, "Accordingly, I am directing the DOD Single Stock Point for Standardization Documents (in Philadelphia) to refuse to publish any new or revised military specifications with an AQL or LTPD as a requirement (i.e., in section 3, 4, or 5) received after June 30, 1989." This policy has been reaffirmed numerous times since, but most specifications today still contain these requirements.

It is appropriate that the contractor develop the testing regime as well as conduct the testing program based on his factory equipment and processes. Specifying specific inspection equipment (e.g., test equipment, gages, etc.) and the amount of inspection (e.g., AQL, sample size, etc.) will limit the efficiency of the manufacturing facility, add cost, and limit competition. The Government, of course, should have the right to approve (or disapprove) the contractor's testing plans before they are implemented. Having established the success criteria for the test program, the supplier should provide proof of this success. Accordingly, the customer will need certificates of conformance to be completed by the contractor or other testing organization. Acceptance of the product should be conditional (among other things) on it passing the testing regime and the supplier maintaining an acceptable Quality System.

Argument may suggest that commercial quality was inadequate in the past and the Government implemented more rigid quality measures. Today, commercial quality techniques are at least equal, or surpass, the Mil-Q-9858 and Mil-I-45208 quality standards. In addition, these quality improvements are much more efficient and cost-effective than the quality requirements imposed in defense contracts today.

Quality Systems are addressed in several Military, National and International Standards. ANSI/ASQC STANDARD Q90-94 and ISO STANDARD 9000-9004 cover Quality Systems for product design, production, installation, servicing and inspection. Many companies have a Quality System which complies with these Standards. Not all, however, have had their Quality System audited by an accredited independent organization, and registered with their National Registration Accreditation Board.

Most manufacturing companies have their own standards, practices, specifications, Quality System, and inspection organization. When a customer buys a product, the quality has been predetermined. As the TV ad states, "The quality goes in before the name goes on." In fact, the quality of every product is determined primarily by the product design and the manufacturing process. The buyer must evaluate and decide which supplier and product (hence which quality) represents the Best Value that meets the need. The past performance of a supplier and the quality of his product must be kept in mind during source selection for new contract awards. Areas for required improvement should be kept in mind during assessments for Continuous Process Improvement.

8.5 CONTINUOUS PROCESS IMPROVEMENT

The Army Materiel Command has developed the "Program for Continuous Process Improvement (CPI)," whose purpose is to assess and measure contractor performance against uniform and definitive standards of excellence, and it is intended that contractor performance against these standards be a consideration in future source selections. CPI provides a means to measure Best Value more objectively through the use of well-defined metrics and uniform assessment elements.

Contractor initiatives under the CPI methodology will be evaluated on a Best Value basis as part of the overall source selection evaluation. Source selection evaluation will consider the lower overall administrative cost to the Government when contracting with a certified facility and the decreased risk associated with various elements of the technical, management and cost proposals.

Solicitations will provide that noncertified contractors must submit, as a minimum, performance data on the offeror's current level of process capability and other performance measures. The source selection evaluation will consider these data in risk assessment associated with the overall evaluation of the offeror's technical, management and cost proposals. Favorable performance data may enhance the final rating of the offeror's proposal.

Procurement involving contractor certification will be on a full and open competition basis, and it is expected that proposals will be received from both certified and noncertified offerors. While certified offerors will have a distinct competitive advantage, noncertified offerors will be treated fairly and equitably under the source selection evaluation methodology described above, and the Government can assure itself that the proposal selected for award, in fact, represents the overall Best Value.

8.6 WARRANTIES AND CERTIFICATES OF CONFORMANCE

Since performance specifications would provide the contractor with greater responsibilities, greater incentives, and more overall control of the hardware and software generated within the acquisition process, one of the Government's primary safeguards to ensure delivery of compliant products must be a strong warranty program. Under such a warranty program, the contractor would warrant the performance of the system against the specific requirements identified in the performance specification. As noted earlier, DOD has had some difficulty developing a strong enforceable warranty program. In a performance based contracting approach, however, DOD needs to demand that the contractor warrant that he built the hardware from the TDP. Obviously, this may raise questions about items, such as source control drawings, which should be resolved before the contractor received an award in the first place.

Incorporation of such a warranty program would represent a major point of departure from many, if not most, warranty programs today, in which the desire on the part of the user to exercise warranty provisions is frequently deterred by the amount of paper or effort required to support it. In all-too-frequent examples of this, the user has been heard to say that "the best part of the (system) warranty program is that it's almost over!" Obviously, if the warranty provisions are difficult to enforce, or require additional out-of-the ordinary effort by the user, their usage will be minimal, and the Government will lose an effective tool. If one of the intents is to move the acquisition process toward a more commercial basis, warranties and their application must progress in that same direction.

A different approach is currently in place on some procurement programs. Under this approach, all failed parts which are removed during the warranty period are returned to the Defense Plant Representative Office (DPRO) at the contractor's facility for repair. If the defect is determined by the DPRO to be a warranty issue, it is repaired or replaced by the contractor under the warranty clause of the contract; if it is determined to be a nonwarranted failure (such as the operator driving over the item, as an extreme example), it is repaired by the contractor under a support services contract. In either case, the system is transparent to the user in the field, and does not require special or peculiar paperwork to effect the hardware transfer or replacement.

While such a program may appear to restrain competition in the "front end" of a production program to the original source, it's in this period that the prime contractor <u>should</u> be held responsible for the adequacy of both the design and the hardware built against that design, including any associated liabilities. For mature programs, however, the situation may be quite different. In this instance, the Government has satisfied itself, through operational tests and/or actual field experience, that the system meets its specified requirements, and the primary warranty requirement becomes one of workmanship against a "proven" design - a situation which is quite similar to that of a commercial warranty.

An additional concern with warranties is that the equipment acquired by the Government could be stored in a depot for an extended time before being issued and found to be defective. Alternately, such problems may be detected after the equipment has been fielded for quite a while. Such concerns are valid ones, and should be addressed "up-front" in the acquisition process - and this is where creativity in writing a good - and fair - warranty comes into play! In such a situation, for example, the Government might choose to pay the contractor for storage of the system and not utilize its own depot, and require that the warranty period commence when the system is removed from storage. Again, this requires that storage and life conditions, if they are critical, have been incorporated within the performance specification to start with!

The Federal Acquisition Regulation (FAR) currently allows the Government to accept products from a contractor on the basis of a Certificate of Conformance (COC) in lieu of traditional test, inspection, and acceptance procedures, if the contractor has consistently demonstrated a high level of integrity, performance, and quality in the products delivered to the Government. Even though this has been a longstanding available procedure to the Government, it has rarely been used, even with the Government's high-quality producers. Increased use of COCs will place greater responsibility on the contractor, as well as reduce costs to both the contractor and the Government with no degradation in the quality of the products accepted and delivered. In addition, the COC provides the Government legal recourse and remedy should the delivered products subsequently be proven to be defective or noncompliant with the contract requirements. The DOD should increase the use of COCs for acceptance of products from high-quality producers.

CHAPTER 9

PERFORMANCE SPECIFICATION BENEFITS

9.1 INTRODUCTION

Historically, DOD has procured the vast majority of its materiel to detailed TDPs. These TDPs include military specifications and standards; detailed manufacturing drawings; manufacturing processes; and detailed inspection procedures, test equipment, and gage designs. This "build to print" philosophy requires a high level of technical and contract administrative activity by both the contractor and the Government; offers little opportunity or incentive for the contractor to improve either the product or his manufacturing processes; and, therefore, limits cost reduction opportunities. As a result of these traditional practices, the DOD has millions of drawings, specifications, and standards it must maintain to support procurement of items and repair parts. Keeping these TDPs current is difficult, costly and time consuming.

Performance specifications have been used successfully as an alternative approach to the procurement of items using detailed TDPs. A properly constructed performance specification can assure the Government a quality product at reduced cost, and greatly reduce Government oversight and contract administration. In addition, the performance specification allows the contractor to become more efficient in his manufacturing operations, to incorporate product enhancements, and to reduce both direct and indirect costs. Some PEOs and PMs have already adopted performance specifications in their acquisition strategies and contracts to the benefit of their programs and DOD.

The performance-based acquisition process steps described in this pamphlet can assist in the transition from TDP-based procurement to performance specifications. The pamphlet identifies the types of issues that should be considered when preparing a specification. The principles and details outlined are generally applicable to all types of specifications. By following the ideas presented, a more useful document can provide the best product to the user at the best value to the American taxpayer.

For these reasons, future emphasis will be to avoid buying "build to print" TDPs and to use performance specifications wherever appropriate. This approach will allow greater flexibility in the design, manufacture, and support of weapon systems. Further, only that technical data needed for competition will be acquired. In all cases, commercial drawing standards and formats are encouraged, and the contractor maintains the technical data current throughout the contract.

Although the primary purpose of this pamphlet is oriented toward the preparation and use of performance specifications, successful implementation requires broader considerations than just the specification itself. It must include the means by which the Government uses the performance specification to acquire quality products and maintain the industrial base; that is, it must encompass the contractual considerations necessary to implement the concept of performance specifications. It is intended to encourage users to think about specific requirements, and to question preconceived solutions, particularly those that add cost with little or no value added.

9.2 MAINTAINING THE INDUSTRIAL BASE

Over the past several years, there have been numerous studies and programs conducted to identify problem areas in the Defense acquisition process, as well as new initiatives implemented to address some of the problem areas identified. Some of the applicable efforts related to specifications and maintenance of a strong industrial base were discussed in chapters 1 and 2. Several recent studies have found that increasing the integration between military and civilian technology and production will lower overall defense costs, promote technology transfer, increase available industrial capacity, and strengthen the economic dimensions of national security. The deep reductions in defense spending make civil-military integration all the more important.

Detailed military specifications and standards have been identified as a major barrier to the required civil-military integration. Peacetime production efficiency will be enhanced by lowering barriers between defense and civilian elements of the DTIB. These barriers also increase defense acquisition costs, place extra burdens on defense contractors seeking to diversify into the civil sector, deter leading edge commercial firms from participating in defense work, and obstruct the flow of technology between the two sectors.

The DTIB will be smaller, but it must still be capable of supporting the DOD in its role as a deployable strategic force. An aggressive role must be taken in identifying the qualities that are required and then ensure that those qualities are enumerated in the acquisition strategies and solicitations. Which companies stay in the defense business is decided every time a contract is signed. These qualities must be in every Request For Proposal and in the source selection process. If they are, we will in effect be buying not just the immediate product, but also the DTIB that will support us into the next decade.

9.3 VALUE ADDED CONSIDERATIONS

A recent American Defense Preparedness Association (ADPA) study found that the DOD pays a premium of between 30 and 50 percent more for products than for the same or similar items sold to a commercial enterprise. The study identified military specifications and standards as significant cost drivers. The major finding of the study is that doing business with the DOD adds cost without adding commensurate value.

Over time, Government specifications and standards have grown to stress the "how to" in all aspects of business operations and technological innovation. This is in sharp contrast to that which is customary on the commercial side, where contracting for "what" and "when" while avoiding the "how to" is commonplace. In addition, Government oversight requires compliance and validation of the "how to," which adds further cost. Indeed, other recent studies have identified the major areas of cost increase between Government and commercial procurement as being most evident in the quality and administrative areas - compliance and verification, and the paper trail of data to certify it.

9.4 ELIMINATION OF HAZARDOUS MATERIALS AND OBSOLETE SPECIFICATIONS

The National Defense Authorization Act for Fiscal Year 1993 imposes new procedures for the elimination of Ozone-Depleting Chemicals (ODC) from DOD contract requirements. Effective 1 June 1993, no DOD contract may include a specification or standard that requires the use of a Class I ODC without approval by a senior acquisition official. This statute is the first of many requirements to eliminate hazardous materials and processes from DOD acquisitions, and to update noncompliant and/or obsolete specifications and TDPs.

With the cutback in defense acquisition, the issue of the nonconforming and/or obsolete specifications, obsolete parts, diminishing sources, and material shortages is becoming even more critical. The problem is evident in the electronics and microcircuit area, as well at the basic material level in the mechanical area. In the area of microcircuits, for example, DOD part requirements usually peak 5 to 10 years after the initial prototypes are developed, and last up to 25 years later. This compares to typical commercial part usage, which peaks within 2 to 3 years and becomes technically and economically obsolete within 4 to 7 years. For example, any dynamic random access memory (DRAM) design (4M, 16M, etc.) has an economic life of 4 years. As a result, the DOD has millions of drawings and specifications which it must update through redesign and requalification of parts in order to support procurement of items and spares beyond the economic life cited above. Alternatively, the Government ends up paying a premium for components which are now obsolete on the commercial market and are thus "special order" items in limited quantities made specifically for a DOD application.

As noted previously, keeping these specifications and TDPs current is difficult, time consuming and costly, particularly with the present engineering change and Government approval process. These changes have been and can be accomplished economically and effectively through the use of performance specifications and performance-based contracting described in this Pamphlet.

9.5 ACQUISITION REFORM

Senior DOD officials are addressing the issue of how to restructure the overly complex and inefficient weapons acquisition process. The difficulty, as always, will be implementation and enforcement of the reforms. An overriding goal of the reforms is to use commercial practices and meld the military and commercial sectors into a single national industrial base. As stated above, DOD cost are 30 to 50 percent higher than comparable commercial items. In addition, these costs could rise as production quantities of military items are reduced.

Such changes to commercial practices will benefit users, the DOD and suppliers. Users will benefit from having new technologies and capabilities available to them through increased competition; the DOD will benefit from increased competition bringing reduced purchasing costs; and suppliers will benefit from having greater access to Government purchasing. Current policies already prescribe the use of performance specifications, but there is an apparent unwillingness to use them. Change will occur only if all departments adopt a deliberate mandate to do so.

Adopting commercial specifications and standards for all but the most critical items is planned. Program managers would be required to obtain special permission to use current military specifications on any future contract. The primary change necessary is from the predominant use of detail technical and fabrication specifications to a greater use of, and reliance on, performance specifications. The difficulty, as always, will be implementation and enforcement of the reforms in a large bureaucracy noted for its resistance to change. Key to its success will be the flow down of these reforms through the PEO and PM organizations and education of the supporting functional personnel.

The proponent of this pamphlet is the United States Army Materiel Command. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to the Commander, HQ AMC, ATTN: AMCRD-IEC, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.

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APPENDIX A-1

A RADICAL REFORM FOR THE

DEFENSE ACQUISITION SYSTEM

from

NEW THINKING AND AMERICAN DEFENSE TECHNOLOGY

A Report of the CARNEGIE COMMISSION
ON SCIENCE, TECHNOLOGY AND GOVERNMENT

May 1993

EXECUTIVE SUMMARY

The Carnegie Commission on Science, Technology, and Government recommends that the Secretary of Defense undertake, with high priority, a radical reform of the defense acquisition system.

The many studies on defense acquisition agree that the system is bloated and inefficient and have made detailed recommendations on how to improve it, but previous attempts have failed because they tried to build on a fundamentally flawed foundation.

What is needed is a complete break with the present system, and the creation of a new system based on the best of the acquisition processes used by large corporations when they undertake major development projects, such as a new generation of commercial transport aircraft. Such a new system would allow the integration over time of the defense industrial base with the commercial industrial base - an integration that will bring not only major benefits to our national security but also important improvements in the competitive posture of many of our largest corporations. It would also signal an important philosophical shift by the new administration tied to the broader goals of strengthening the national economy and reducing the size of government.

THE PROBLEM

Previous studies by the Defense Science Board, the Grace Commission, the Packard Commission, the Congress, and a number of universities have documented the inefficiencies of the present acquisition process. Congress and the Defense Department, in an effort to eliminate waste, fraud and abuse, have created a myriad of laws and regulations, which in turn have led to thousands of documents describing in elaborate detail how every weapon - and every belt buckle - should be developed and procured. The Defense Department has established an army of several hundred thousand acquisition personnel to oversee the process spelled out in these documents. Industry in turn has added hundreds of thousands of people to their staffs to cope with the government overseers. All of this overhead structure is paid for, one way or another, by the taxpayers.

It is impossible to estimate precisely the full cost of regulation in the present acquisition system; however, a surrogate for regulation cost is the cost of the personnel in DoD and the defense industry dedicated to management and control. That cost in FY 1991 is estimated to be over $50 billion, or about 40 percent of the acquisition budget for that year. (This compares with management and control burdens in commercial business that range from 5 to 15 percent.) The high overhead costs are not the only problem with the present acquisition process. It also imposes severe schedules penalties - the acquisition schedule that results from this process are two to three times as long as commercial schedules for comparable systems. (The B-2 acquisition schedule, for example, is about three times that of the Boeing 767.) And there are serious performance penalties as well - nearly all of our military systems embody technology that is a generation or two behind their commercial counterparts.

These well-documented efficiencies, which have plagued us for many years, are compounded by three problems arising from the significant downturn in defense spending now under way and likely to continue for a number of years.

- First, as defense spending decreases, the overhead cost of regulation (management and control), which is already about 40 percent of the acquisition budget, would consume as much as 70 percent of that budget if the present overhead control structure were left in place. Both the DoD and defense contractors will need to downsize their management and control staffs at least proportionally to the decreased size of the defense budget. But simple downsizing is not enough; we should also take this opportunity to restructure our defense acquisition process around modern management techniques. During the last few years, our most successful commercial industries have all restructured their manufacturing processes and support teams - based on Total Quality Management concepts, statistical quality control, and just-in-time inventory - in order to achieve increased competitiveness in world markets. Defense should do no less!

- **Second, while many defense companies have tried to convert to the production of commercial products in response to changes in defense spending, they have been largely unsuccessful because of the overhead burden and inefficient processes that are the legacy of the present defense acquisition process. Defense engineers and managers are among the best in the world, and they could readily develop the capability to compete in commercial markets if they became trained in commercial practices.**

- Finally, with the downsizing now under way, our defense industrial base will provide too small a base if our country ever needs to reconstitute a major defense production capacity. If that contingency arose, we would have to build on the then-existing commercial/industrial base just as we did at the beginning of World War II. However, our defense equipment and acquisition process is now encumbered by a bewildering array of defense-peculiar standards and processes that have proliferated since World War II and that are incompatible with the processes and standards used by our commercial industry. (Indeed, large corporations that have both a defense and a commercial business currently structure them in separate organizations, usually physically separated, so that the defense processes will not "contaminate" their commercial business.)

THE RECOMMENDED SOLUTION

The reform of the defense acquisition system must have as its principal thrust the integration of the country's defense and commercial industry to create a single industrial base.

Given the expected size of the defense industry in the 1990s, the increased importance of commercial technology to defense, and the need of our commercial industry to get the full benefits of defense technology advances, we can no longer afford the luxury of maintaining two distinct industrial bases.

Achieving this integration requires making a complete break with the present system. The needed reform consists of replacing the current acquisition system with an existing system that needs no new invention and that is used by most companies every day:common commercial buying practices. *The critical ingredient of adaptation to commercial practice is conversion from a regulation-based system to a market-based system.* Numerous studies have made it clear that the problems with the defense acquisition system are rooted deeply in the regulation-based system of procurement, with its insidious system of "allowable overhead." Such a system is clearly vulnerable to abuse by contractors who are careless about passing unallowable costs on to the government. The government responds to this vulnerability of the public purse by dispatching thousands of inspectors and auditors to oversee defense contractors. These government contractors in turn are matched - on a person-by-person basis at least - by counterpart accountants and auditors employed by industry. Eliminating this fundamental vulnerability to abuse and making drastic reductions in the personnel superstructure that goes with it would reduce defense expenditures by several tens of billions of dollars each year. By way of illustration, if we had been able to reduce the management and control burden in last year's acquisition budget to 20 percent (still more than is typical in commercial practice), $25 billion would have been saved that year.

The Task Force believes that this is a practical and achievable reform and that a transition from the old system to a new one can be accomplished smoothly. The strategy is to create simply worded legislation and regulation changes that will enable and encourage the Secretary of Defense to apply best commercial practices and gradually withdraw from the present system. To change all of the current contracts, organizations, and procedures of the department immediately would, of course, be impractical. However, it is realistic to begin immediately by permitting commercial practices to be used now where practical. Both the current system and the new price-based, commercial-practice system would operate in parallel for several years as the Department of Defense gradually moves programs, contracts, organizations and procedures into this new mode. It should be possible to move most of the procurement activity to the new process within the first four-year term of the administration.

To move to a new market-based system must not and need not dilute the government's obligation to assure that it obtains fair value for the taxpayer's money, with equitable treatment for all contractors. The Commission is aware that government procurement will always operate under different constraints from private sector procurements. But under the new system, many tools will continue to be available to the government to meet its unique needs and constraints for spending public monies, which will be at least as effective as the current practice of determining in detail the cost of a product in order to decide what to pay for it. Competition will continue to be available in most circumstances - it will simply take place on the basis of value rather than cost. Commercial practices contain sensible ways of establishing a fair price. Very importantly, the government has an obligation to understand the value of what it wishes to acquire. Today's archaic and destructive "requirements process" results in neither a real determination of what is required nor any attempt to establish value, and this process should be changed in any event. Managing risk in high-technology programs is now well understood in commercial practice, and there are many mechanisms available to achieve that effectively in the new system. We can and must use these commercial techniques to the public's advantage.

IMPLEMENTATION ISSUES

Implementing this recommendation will be very difficult because the present defense acquisition system is deeply ingrained in practice and law. Long-established ways of doing business would have to be changed; many institutional oxen would be gored. Thus, to effect such a fundamental change will require a major commitment of political capital by the President and the Secretary of Defense to gain the support of the services and the key committees of Congress. Service support would be facilitated if the Secretary of Defense makes clear from the beginning that the basic role of the services in acquisition would be maintained; in other words, this is not a move to centralize defense acquisition and move it away from the users. **Congressional support would be facilitated if the President organized a commission, patterned after the "base-closing" commission, to recommend the necessary changes**

in acquisition law and agency mandates, including phasing down agencies or subagencies where necessary.

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This initiative would send an important signal that the new administration is serious about national security as well as economic well-being; indeed, it emphasizes that they are closely interrelated. Successfully implemented, it will result in huge gains in efficiency and effectiveness, and will allow us to establish a strong defense capability while we are making major reductions in defense spending. The effort required would be substantial, but the prize is large - in reduced expenditures, in increased national security, and in the increased strength of our national industrial base.

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APPENDIX A-2

ASA(RDA) AND CGAMC CORRESPONDENCE

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

6 AUG 1992

SARD-PP

MEMORANDUM FOR THE ARMY ACQUISITION COMMUNITY

SUBJECT: Reducing Functional Requirements

To reinforce a key message presented during the recent joint Army and Army Materiel Command-team visits to the acquisition community, we charge each of you with challenging functional requirements in every aspect of an acquisition. We cannot afford to thoughtlessly use all the "safety nets" built-up as the norm for executing programs. We must commit to managing, versus eliminating, risk.

At the outset of a program, we must start with a clean slate, tailoring the acquisition strategy and solicitation for that particular case and embracing functional requirements only as absolutely necessary. Our operative mode must be to rationalize each functional requirement, data item and report in every program planning and contractual document. Leave out those that add no value, or so little as to not be cost effective.

The Head of the Contracting Activity, in coordination with the appropriate Program Executive Officer (PEO) and Program Manager (PM), shall ensure that those functional requirements included in solicitations and contracts are justified as essential and cost effective. PMs and PEOs shall review all non-contractual functional requirements, and challenge those that appear excessive or do not add value to the Army. Disagreements between functional proponents and PMs and PEOs as to whether a requirement is essential shall be decided by the Milestone Decision Authority. The burden of proof lies with the functional proponent.

This policy is to be implemented immediately and applies to all acquisition programs. It will be incorporated in the Army Federal Acquisition Regulation Supplement by the end of FY 1992. Procedures will be in the forthcoming AMC Request for Proposal Handbook.

Jimmy D. Ross
General, U.S. Army
Commanding
U. S. Army Materiel Command

Stephen K. Conver
Assistant Secretary of the Army
(Research, Development and Acquisition)

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

TOBY WARSON
SEP 17 1992

4 SEP 1992

SARD-PP

Mr. Toby G. Warson
President and Chief Executive Officer
Alliant Techsystems, Incorporated
5901 Lincoln Drive
Edina, Minnesota 55436

Dear Mr. Warson:

For some time, I and my staff, and the Army Materiel Command (AMC), have been spreading a message -- each member of the Army acquisition community has a duty to challenge functional requirements imposed on every aspect of an acquisition. "Functional requirements" are all those plans, provisions, tests, reports and other data items, and specifications and standards pertaining to a procurement.

To that end, General Ross and I have sent the enclosed memorandum to the Army acquisition community, to enlist their active assistance in eliminating functional requirements that add little or no value to a procurement. I want the assistance of the private-sector members of the community as well, and that is the purpose of this letter.

Please review all acquisition-related documents that you receive. Are the functional requirements in them appropriate for the strategy, phase of the acquisition cycle and contract type of the particular acquisition? Are the requirements cost effective? I want you to challenge all requirements where the answer to these questions is "no." Issue your challenge to the appropriate party as indicated in the enclosed memorandum. For AMC procurements..also raise the issue with Mr. Lewis J. Ashley, the AMC Ombudsman. His address is 5001 Eisenhower Avenue, Alexandria, Virginia 22333-0001. His phone number is (703) 274-8252.

Thank you very much for your help and support.

Sincerely,

Stephen K. Conver
Assistant Secretary of the Army
(Research, Development and Acquisition)

Enclosure

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APPENDIX B

MILITARY SPECIFICATION MIL-P-11286L (ER)

PARTS, MATERIALS, AND PROCESSES USED IN ELECTRONIC EQUIPMENT

(excerpted from Section 2)

MIL-P-11268L (ER)
28 December 1983
SUPERSEDING
MIL-P-11268K(ARMY)
31 August 1978

MILITARY SPECIFICATION

PARTS, MATERIALS, AND PROCESSES USED IN ELECTRONIC EQUIPMENT

...

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following requirements, standards, and handbooks of the issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

C-F-202	-	Felt Sheet (Hair) and Felt Roll (Hair).
C-F-206	-	Felt Sheet, Cloth, Felt, Wool, Pressed.
F-F-300	-	Filter, Air Conditioning, Viscous-Impregnated and Dry Types, Cleanable.
J-W-1177	-	Wire, Magnet, Electrical.
L-P-349	-	Plastic Molding and Extrusion material, Cellulose Acetate Butyrate.
L-P-380	-	Plastic Molding Material, Methacrylic.
L-P-383	-	Plastic Materials, Polymer Resin, Glass Fiber Base, Low Pressure Laminated.
L-P-385	-	Plastic Molding Material, Polychlorotrifluorethylene.
L-P-387	-	Plastic Sheet, Laminated. Thermosetting (for Designation Plates).
L-P-389	-	Plastic Molding material, FEP Fluorocarbon Molding and Extrusion.

L-P-390	-	Plastic Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density).
L-P-392	-	Plastic Molding Material, Acetal, Injection and Extrusion.
L-P-393	-	Plastic Molding Material, Polycarbonate, Injection and Extrusion.
L-P-394	-	Plastic Molding Material, Polypropylene, Injection and Extrusion.
L-P-395	-	Plastic Molding (and Extrusion) Material, Nylon, Glass Fiber, Reinforced.
L-P-396	-	Plastic Molding and Extrusion Material, Polystyrene.
L-P-397	-	Plastic Molding Material, Cellulose Acetate.
L-P-398	-	Plastic Molding Material, Styrene-Butadiene.
L-P-399	-	Plastic Molding and Extrusion Material, Styrene-Acrylonitrile Copolymers.
L-P-403	-	Plastic Molding Material, Polytetrafluoroethylene (TFE)-Fluorocarbon.
L-P-504	-	Plastic Sheet and Film, Cellulose Acetate.
L-P-506	-	Plastic Sheet and Film, Polystyrene, Biaxially Oriented.
L-P-512	-	Plastic Sheet (Sheeting); Polystyrene.
L-P-513	-	Plastic Sheet and Insulation Sheet (Laminated). Thermosetting, Paper-Base, Phenolic-Resin).
L-P-516	-	Plastic Sheet and Plastic Rod, Thermosetting, Cast.
L-P-523	-	Plastic Sheet and Film, FEP - Fluorocarbon, Extruded.
L-P-535	-	Plastic Sheet(Sheeting) Plastic Strip, Vinyl Chloride Polymer and Vinyl Chloride Vinyl Acetate Copolymer, Rigid.
L-P-1035	-	Plastic Molding Material, Vinyl Chloride Polymer and Vinyl Chloride Vinyl Acetate Copolymer, Rigid.
L-P-1041	-	Plastic Molding and Extrusion Material, Vinylidene Chloride Vinyl Chloride Copolymer.
L-P-1183	-	Plastic Molding Material, Acrylonitrile-Butadiene-Styrene (ABS) Rigid.
O-L-164	-	Leather Dressing, Mildew-Preventive.
W-C-596	-	Connector, Cable Outlet. Electrical, Specific purpose, Cable Connecting, General Grade, Locking, 2 Pole, 2 Wire, 15 Amperes, 125 Volts, 50/60 Hertz.
FF-S-111	-	Screw, Wood.
FF-S-200	-	Setscrews; Hexagon Socket and Spline Socket, Headless.

FF-S-210	-	Setscrews; Square Head and Slotted Headless.
NN-P-530	-	Plywood, Flat Panel.
QQ-B-750	-	Bronze, Phosphor, Bar, Plate, Rod, Sheet, Strip, Flat Wire and Structural and Special Shaped Sections.
QQ-C-390	-	Copper Alloy Castings (Including Cast Bar).
QQ-P-416	-	Plating, Cadmium (Electrodeposited).
QQ-S-571	-	Solder; Tin Alloy; Tin-Lead Alloy; and Lead Alloy.
QQ-W-343	-	Wire, Electrical (Uninsulated).
TT-C-490	-	Cleaning Methods and pretreatment of Ferrous Surfaces for organic Coatings.
TT-P-1757	-	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity.
ZZ-R-765	-	Rubber, Silicone.
CCC-C-419	-	Cloth, Duck, Cotton, Unbleached, Piled-Yarn, Army and Numbered.
CCC-D-950	-	Dyeing and After Treating Processes for Cotton Cloths.

MILITARY

MIL-I-10	-	Insulating Materials, Electrical, Ceramic, Class L.
MIL-M-14	-	Molding Plastics and Molding Plastic Parts, Thermosetting.
MIL-C-17	-	Cable, Radio Frequency, Flexible and Semi-Rigid, General Specification For.
MIL-S-61	-	Shunts, Instrument, External, 50 Millivolt (Light Weight Type).
MIL-P-79	-	Plastic Rods and Tubes, Thermosetting, Laminated.
MIL-C-92	-	Capacitors, Variable, Air Dielectric (Trimmed), General Specifications For.
MIL-V-95	-	Vibrators, Interrupter and Self-Rectifying.
MIL-T-152	-	Treatment, Moisture and Fungus Resistant, of Communications, Electronic, and Associated Electric Equipment.
MIL-V-173	-	Varnish, moisture and Fungus Resistant (for the Treatment of Communications, Electronic, and Associated Electrical Equipment).
MIL-I-631	-	Insulation, Electrical, Synthetic-Resin Composition, Nonrigid.
MIL-J-642	-	Jacks, Telephone, General Specification For.

MIL-P-642	-	Plugs, Telephone, and Accessory Screws, General Specifications For.
MIL-T-713	-	Twine, Fibrous, Impregnated, Lacing and Tying.
MIL-P-997	-	Plastic-Materials, Laminated, Thermosetting Electrical-Insulating: Sheets, Glass Cloth, Silicon Resin.
DOD-D-1000	-	Drawings, Engineering and Associated lists.
MIL-I-1361	-	Instruments, Auxiliaries, Electrical Measuring; Shu Resistors, and Transformers.
MIL-F-2312	-	Felt, Hair, or Wool, Mildew Resistant, and moisture Resistant, Treatment For.
MIL-R-3065	-	Rubber, Fabricated Parts.
MIL-C-3093	-	Cable, Telephone, Inside Distribution Wiring, (WD-15/U, WF-9/U, and WF-3/U).
MIL-C-3098	-	Crystal Units, Quartz, General Specifications For.
MIL-C-3133	-	Cellular Elastomeric Materials, Molded or Fabricated Parts.
MIL-V-3144	-	Vials, level.
MIL-I-3158	-	Insulation Tape, Electrical Glass-Fiber (Resin-Filled): and Cord, Fibrous-Glass.
MIL-P-3409	-	Plastic-Material, Molding, Rigid Thermoplastic Polydichlorostyrene, For Use in Electrical Communications, and Allied Electrical Equipment.
MIL-C-3432	-	Cable and Wire, Electrical (Power and Control; Flexible and Extra Flexible, 300 and 600 Volts).
MIL-F-3541	-	Fittings, lubrication.
MIL-C-3607	-	Connectors, Coaxial, Radio Frequency, Series Pulse, General Specifications For.
MIL-C-3655	-	Connector, Plug and Receptacle, Electrical (Coaxial, Series, Twin), and Associated Fittings, General Specifications For.
MIL-C-3849	-	Cord, Electrical (Tinsel).
MIL-C-3883	-	Cord, Electrical (Audio Frequency).
MIL-C-3884	-	Cord, Electrical (Short Lay).
MIL-C-3885	-	Cable Assemblies and Cord Assemblies, Electrical.
MIL-L-3890	-	Lines, Radio Frequency Transmission (Coaxial, Air Dielectric).
MIL-K-3926	-	Knobs, Control (for Use with Electronic, Communications, and Allied Equipment).
MIL-S-3950	-	Switches, Toggle, Environmentally Sealed, General Specifications For.

MIL-M-3971	-	Meters, Time Totalizing, Non-Hermetically Sealed, Electrical: General Specifications For.
MIL-B-5423	-	Boots, Dust and Water Seal (For Toggle and Pushbutton Switches and Rotary-Actuated Parts), General Specifications For.
MIL-P-5425	-	Plastic Sheet, Acrylic, Heat-Resistant.
MIL-R-6106	-	Relay, Electromagnetic (Including Established reliability) Er (Type), General Specifications For.
MIL-R-7362	-	Rubber, Synthetic, Solid, Sheet and Fabricated Parts, Synthetic Oil Resistant.
MIL-I-7444	-	Insulation Sleeving, Electrical, Flexible.
MIL-P-8053	-	Panel, Information, Integrity, Illuminated.
MIL-C-8073	-	Plywood, Metal-Faced.
MIL-P-8184	-	Core material, Plastic Honeycomb, Laminated Glass Fiber Base, for Aircraft Structural and Electrical Applications.
MIL-S-8805	-	Plastic Sheet, Acrylic, Modified.
MIL-S-8834	-	Switches and Switching Assemblies, Sensitive and Push Snap-Action, General Specifications For.
MIL-I-8846	-	Switches, Toggle, Positive-Break, General Specifications For.
MIL-H-10056	-	Inserts, Screw Thread, Helical Coil.
MIL-C-10065	-	Cables, Special Purpose, Electrical (Multipair, Audio Frequency).
MIL-C-10392	-	Cord, Electrical ((Audio, Miniature).
MIL-C-10544	-	Connectors, Plug and Receptacle (Electrical, Audio, Waterproof, Ten Contact, Polarized).
MIL-C-10578	-	Corrosion Removing and Metal Conditioning Compound (Phosphoric Acid Base).
MIL-C-10581	-	Cable, Telephone WF-8( )/G.
MIL-P-10971	-	Pins, Spring, Tubular (Coiled and Slotted).
MIL-C-12520	-	Connectors, Plug and Receptacle (Electrical Waterproof); and Accessories; General Specifications For.
MIL-T-12554	-	Treatment, Fungus Resisting, Paranitrolphenol, For Cork Products.
MIL-M-13231	-	Marking of Electrical Items.
MIL-C-13273	-	Cord, Electrical (Retractile, 2, 3, and 4 Conductor, (WD-9/U, WD-2/U, WWD-4/U).
MIL-C-13777	-	Cable, Special Purpose, Electrical: General Specifications For.

MIL-F-14072	-	Finishes For Ground Electrical Equipment
MIL-F-14256	-	Flux, Soldering, (Resin Based).
MIL-P-15024/6	-	Plates, Identification.
MIL-P-15024/8	-	Plates, Tags, and band identification, Cable Assembly, Type K2 Heat Shrinkable Tubing
MIL-P-15035	-	Plastic Sheet: Laminated, Thermosetting, Cotton-fabric-based, Phenolic-Resin
MIL-P-15037	-	Plastic Sheet, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin.
MIL-P-15047	-	Plastic-material, Laminated Thermosetting, Sheets, Nylon Fabric Base, Phenolic-Resin.
MIL-F-15160	-	Fuses; Instrument, Power, and Telephone.
MIL-F-15733	-	Filters, Radio Interference, General Specifications For.
MIL-M-16034	-	Meters, Electrical-Indicating (Switchboard and Portable Types).
MIL-B-16540	-	Bronze, Phosphor, Castings.
MIL-F-16552	-	Filter, Air Environmental Control Systems, Cleanable, Impingement (High Velocity Type).
MIL-P-18177	-	Plastic Sheet, Laminated, Thermosetting, Glass Fiber Base, Epoxy-Resin.
MIL-P-18324	-	Plastic Material, Laminated Phenolic, For Bearings (Water of Grease lubricated).
MIL-F-18352	-	Filters: High pass, Low Pass, Band Pass, band Suppression, and Dual functioning, General Specifications For.
MIL-P-19161	-	Plastic Sheet, Laminated, Glass Cloth Polytetrafluoro-ethylene Resin.
MIL-P-19468	-	Plastic Rods, Polytetrafluoroethylene, Molded and Extruded.
MIL-S-19500	-	Semiconductor Devices, General Specifications For.
MIL-C-19547	-	Cable, Electrical, Special purpose, Shore Use.
MIL-G-20098	-	Gypsum, Calcined.
MIL-M-20693	-	Molding plastic, Polyamide (Nylon), Rigid.
MIL-P-20700	-	Pins, Grooved, headless, longitudinal Grooves.
MIL-P-21347	-	Plastic Molding Material, Polystyrene, Glass Fiber Reinforced.
MIL-I-21557	-	Insulation Sleeving, Electrical, Flexible, Glass Fiber, Vinyl Treated.
MIL-C-21617	-	Connector, Plug and Receptacle - Electrical Rectangular, polarized Shell, Miniature Type.

MIL-P-22096	-	Plastic, Polyamide (Nylon), Flexible Molding and Extrusion material.
MIL-I-22129	-	Insulation Tubing, Electrical, Polytetrafluorethylene Resin, Nonrigid.
MIL-P-22241	-	Plastic Sheet (and Film) Polytetrafluoroethylene (TFS-Fluorocarbon Resin).
MIL-P-22296	-	Plastic tubes and Tubing Polytetrafluoroethylene (TFS-Fluorocarbon Resin), Heavy Walled.
MIL-P-22324	-	Plastic Sheet, Laminated, thermosetting, Paper-Base, Epoxy-Resin.
MIL-T-22361	-	Thread Compound, Antiseize, Zinc Dust-Petrolatum.
MIL-C-22520	-	Crimping tools, Terminals, Hand or Power Actuated, Wire Termination and Tool Kits, General Specifications For.
MIL-C-22931	-	Cable, Radio Frequency, Semirigid Coaxial, Semi-air-dielectric, General Specifications For.
MIL-C-22992	-	Connector, Plugs and Receptacles, Electrical Waterproof, Quick Disconnect, Heavy Duty type, General Specification For.
MIL-I-23053	-	Insulation Sleeving, Electrical, Heat Shrinkable, General Specifications For.
MIL-I-23053/5	-	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked.
MIL-B-23071	-	Blower, Miniature, for Cooling Electrical Equipment (10 to 500 CFM), General Specifications For.
MIL-S-23190	-	Straps, Clamps and Mounting Hardware, Plastic For Cable Harness Tying and Support.
MIL-I-23264	-	Insulator, Standoff, (Style 01, 02, 03, 04, and 06).
MIL-F-23419	-	Fuse, Instrument Type, General Specification For.
MIL-C-23437	-	Cable, Electrical, Shielded Pairs.
MIL-C-24308	-	Connector, Electric, Rectangular, Miniature polarized Shell, Rack and Panel, General Specifications For.
MIL-M-24325	-	Molding material, Plastic Epoxy Compound, Thermosetting.
MIL-I-24391	-	Insulation tape, Electrical plastic, Pressure Sensitive.
MIL-M-24519	-	Molding Plastic, Polyester, Thermoplastic.
MIL-P-25515	-	Plastic Materials, Phenolic-Resin, Glass-Fiber Base, Low Pressure laminated.
MIL-P-25518	-	Plastic Materials, Silicone Resin, Glass-Fiber Base, Low Pressure laminated.

MIL-R-25988	-	Rubber, Fluorosilicone Elastomer, Oil-and-Fuel Resistant, Sheets, Strips, Molded Parts, and Extruded Shapes.
MIL-C-26482	-	Connector, Electrical (Circular, miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specifications For.
MIL-C-27072	-	Cable, Special Purpose, Electrical, Multiconductor.
MIL-A-27434	-	Adapters, Connector, Coaxial, Radio Frequency, Between Series, General Specifications For.
MIL-C-27599	-	Connector, Electrical, Miniature, Quick Disconnect (For Weapons Systems) Established Reliability.
MIL-R-27777	-	Relays, Telegraph, Passive, Solid-state, General Specifications For.
MIL-R-28750	-	Relay, Solid State, General Specifications For.
MIL-R-28776	-	Relays, Hybrid, Established Reliability, General Specifications For.
MIL-P-28809	-	Printed-Wiring Assemblies.
MIL-M-38510	-	Microcircuits, General Specifications For.
MIL-M-38527	-	Mounting pads and Insulator Disks, Electrical-Electronic Components, General Specifications For.
MIL-C-38999	-	Connector, Electrical, Circular, Miniature, high Density, Quick Disconnect (Bayonet, Threaded and Breech Coupling), Environment Resistant Removable Crimp and Hermetic Solder Contacts, General Specifications For,
MIL-C-39010	-	Coils, Fixed, Radio Frequency, Molded, Established Reliability, General Specifications for.
MIL-C-39012	-	Connector, Coaxial, Radio Frequency, General Specification For.
MIL-R-39016	-	Relay, Electromagnetic, Established Reliability, General Specification For.
MIL-O-39021	-	Ovens, Crystal, General Specification For.
MIL-P-40619	-	Plastic material, Cellular, Polystyrene (For Buoyant Applications)
MIL-T-43435	-	Tape, lacing and Tying.
MIL-I-45914	-	Insert, Screw Thread-Locked In, key lock.
MIL-S-45915	-	Stud, Locked In-key Lock.
MIL-I-45916	-	Insert, Screw Thread-Thread Cutting and Thread Forming.
MIL-I-46058	-	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies).

MIL-P-46112	-	Plastic Sheet and Strip, Polyamide.
MIL-P-46120	-	Plastic molding and Extrusion Material, Polysulfane.
MIL-P-46129	-	Plastic molding and Extrusion Material, Polyphenylene Oxide, modified.
MIL-P-46161	-	Plastic Molding Material, Polyterephthalate Thermoplastic, Glass Fiber Reinforced.
MIL-C-49055	-	Cable Special purpose Electrical, (Flexible, Flat Unshielded), (Round Conductor), (Wire Size 20, 600 Volts, 105 Deg C and 150 Deg C.)
MIL-P-50884	-	Printed-Wiring, Flexible, General Specification For.
MIL-C-55021	-	Cable, Twisted Pair and Triples, Internal Hookup.
MIL-C-55036	-	Cable, Telephone WM-130 ( )/G.
MIL-C-55074	-	Connector, Plug and receptacle, Telephone, Electrical, Subassembly and Accessories and Contact Assembly, Electrical, General Specification For.
MIL-C-55081	-	Connector, Plug, Electrical U-176( )/G; Connector, Plug, Electrical U-319( )/G; Connector, Receptacle Electrical U-121( )/G; Connector, Receptacle, Electrical, U-122( )/G.
MIL-P-55110	-	Printed Wiring Boards.
MIL-C-55116	-	Connectors, Miniature Audio, Five-pin.
MIL-C-55181	-	Connectors, plug and Receptacle, Intermediate (Electrical) (Waterproof), General Specification For.
MIL-C-55235	-	Connectors, Coaxial, Radio Frequency, Serial TPS.
MIL-C-55245	-	Connector, Plug and Receptacle, Electrical, Quick Connect and Disconnect, 12 Contacts, Medium power.
MIL-C-55302	-	Connector, Printed Circuit Subassembly and Accessories, Plug, Pin Contacts, Right Angle, For Multilayered Printed Wiring Boards (.100 Spacing).
MIL-O-55310	-	Oscillators, Crystal, General Specification For.
MIL-A-55339	-	Adapters, Connector, Coaxial, Radio Frequency (Between Series and Within Series), General Specification For.
MIL-R-55342	-	Resistor, Fixed, Film, Chip, Established Reliability, Style Rm 2208.
MIL-C-55357	-	Cable, Telephone, Shielded (Inside Wiring).
MIL-C-55365	-	Capacitor, Chip, Fixed Tantalum, Established Reliability, General Specification For.
MIL-S-55433	-	Switch, Reed, General Specification For.

MIL-C-55446	-	Cable, telephone, Switchboard, Plastic Insulated, Plastic Jacketed.
MIL-C-55483	-	Cable Assembly, Special Purpose, Electrical, CX-11230( )/G, Cable Assembly Adapter CX-10734( ).
MIL-S-55620	-	Substrate, Ceramic, For Deposition of thin Film microcircuits.
MIL-C-55668	-	Cord, Electrical, Audio, Subminiature (Retractile and Straight)
MIL-C-55681	-	Capacitor, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification For.
MIL-I-81531	-	Marking of Electrical Insulated Materials.
MIL-W-81822	-	Wire, Electrical, Solderless Wrap, Insulated and Uninsulated.
MIL-I-81969	-	Installing and Removal Tools, Connector Electrical Contact, General Specification For.
MIL-R-83248	-	Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant.
MIL-C-83503	-	Connector, Electrical, Flat Cable, Nonenvironmental, General Specification For.
MIL-S-83731	-	Switches, Toggle, Unsealed and Sealed Toggle, General Specification For.

STANDARDS

FEDERAL

FED-STD-H28	-	Screw Thread Standards For Federal Services.

MILITARY

DOD-STD-35	-	Automated Engineering Document Preparation System.
DOD-STD-100	-	Engineering Drawing Practices.
MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	-	Marking For Shipment and Storage.
MIL-STD-143	-	Standards and Specifications Order of Precedence for Selection of.
MIL-STD-198	-	Capacitors, Selection and Use of.
MIL-STD-199	-	Resistors, Selection and Use of.

MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-252	-	Wired Equipment, Classification of Visual and Mechanical Defects.
MIL-STD-275	-	Printed Wiring for Electronic Equipment.
MIL-STD-276	-	Impregnation of Porous Nonferrous Metal Castings.
MIL-STD-417	-	Classification System and Tests for Solid Elastomeric Materials.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment (For Limitations see Section 3).
MIL-STD-481	-	Configuration Control-Engineering Changes, Deviations and Waivers (Short Form)
MIL-STD-482	-	Configuration Status Accounting Data Elements And Related Features.
MIL-STD-681	-	Identification Coding and Application of Hookup and Lead Wire.
MIL-STD-683	-	Crystal Units (Quartz) and Holders (Enclosed), Selection of.
MIL-STD-690	-	Failure Rate Sampling Plans and Procedures.
MIL-STD-750	-	Test methods for Semiconductor Devices.
MIL-STD-810	-	Environmental Test Methods.
MIL-STD-883	-	Test Methods and Procedures for Microelectronics.
MIL-STD-963	-	Parts Control Program.
MIL-STD-1130	-	Connection, Electrical, Solderless, Wrapped.
MIL-STD-1277	-	Splices, Clips, Terminals, Terminal Boards, Binding Posts, Electrical.
MIL-STD-1286	-	Transformers, Inductors, and Coils, Selection and Use of.
MIL-STD-1346	-	Relays, Selection and Application.
MIL-STD-1395	-	Filters and Networks, Selection and Use of.
MIL-STD-1498	-	Circuit Breakers, Selection and Use of.
DOD-STD-1685	-	Electronic Discharge Control program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Exposure Devices) (Metric)
MS35335	-	Washer, Lock, Flat-External Tooth.
MS91528	-	Knob-Control, Plastic (Round, Concentric, Pointer, Spinner, Spinner Slip Clutch, Bar, Tactile, Knob Lock Pointer, and Knob Locks).

HANDBOOKS

MILITARY

MIL-HDBK-216	RF Transmission Lines and Fittings.
DOD-HDBK-263	Electrostatic Discharge Control handbook for Protection Of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)

2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

DRAWINGS

ELECTRONICS COMMAND

SC-A-19100	-	Hardware for Chests and Cases.
SC-A-46420	-	Fasteners.
SC-A-47183	-	Hardware for Canvas and Leather Items.
SC-A-47794	-	Wood Guide.
SC-B-61578	-	Grounding to Chassis.
SC-D-164859	-	Cable Assembly, Special Purpose, Electrical.//Sample Drawing
SC-A-434065	-	Cable, Radio Frequency WD-37( )/U
DL-SC-B-883956		Cable Assemblies, Electrical Power, 40A, 60A, 100A, and 200A.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN GEAR MANUFACTURING ASSOCIATION (AGMA)

Publications Index

(Application for copies should be addressed to the American Gear manufacturers Association, 1 Thomas Circle, Washington, DC 20005)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A582	-	Free-Machining Stainless and Heat resisting Steel Bars, Hot-Rolled or Cold-Finished, Specification For.
ASTM D787	-	Ethyl Cellulose Molding and Extrusion Compounds, Specification For.
ASTM D2000	-	Standard Classification System for Rubber Products in Automotive Applications.
ASTM G21	-	Resistance of Synthetic Polymeric materials to Fungi.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

COLOR ASSOCIATION OF UNITED STATES, INCORPORATED

Department of Defense Standard Shades for Sewing Threads.

(Application for copies should be addressed to the Color Association of the United States, Incorporated, 200 Madison Avenue, NYC, NY 10016.)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

RS-463	-	Fixed Aluminum Electrolytic Capacitors For Alternating Current Motor Starting Heavy Duty (Type 1) and For Light Duty (Type 2).

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, NW, Washington, DC 20006.)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

The Registry of Toxic Effects of Chemical Substances.

(Application for copies should be addressed to the US Department of Health, Education, and Welfare, Rockville, Maryland 20852.)

3. REQUIREMENTS

..... (MIL-SPEC continues with requirements)

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APPENDIX C-1

SIGNAL CORPS SPECIFICATION NO. 486

ADVERTISEMENT AND SPECIFICATION FOR A HEAVIER-THAN-AIR FLYING MACHINE

(underlining in this copy added for emphasis)

Signal Corps Specification No. 486

Advertisement and Specification for a
Heavier-than-Air Flying Machine

TO THE PUBLIC

Sealed proposals, in duplicate, will be received at this office until 12 o'clock noon on February 1, 1908, on behalf of the Board of Ordnance and Fortification for furnishing the Signal Corps with a heavier-than-air flying machine. All proposals received will be turned over to the Board of Ordnance and Fortification at its first meeting after February 1 for its official action.

Persons wishing to submit proposals under this specification can obtain the necessary forms and envelopes by application to the Chief Signal Office, United States Army, War Department, Washington, D.C. The United States reserves the right to reject any and all proposals.

Unless the bidders are also the manufacturers of the flying machine they must state the name and place of the maker.

Preliminary - This specification covers the construction of a flying machine supported entirely by the dynamic reaction of the atmosphere and having no gas bag.

Acceptance - The flying machine will be accepted only after a successful trial flight, during which it will comply with all requirements of this specification. No payments on account will be made until after the trial flight and acceptance.

Inspection - The Government reserves the right to inspect any and all processes of manufacture.

GENERAL REQUIREMENTS

The general dimensions of the flying machine will be determined by the manufacturer, subject to the following conditions:

1. Bidders must submit with their proposals the following:

(a) Drawings to scale showing the general dimensions and shape of the flying machine which they propose to build under this specification.

(b) Statement of the speed for which it is designed.

(c) Statement of the total surface area of the supporting planes.

(d) Statement of the total weight.

(e) Description of the engine which will be used for motive power.

(f) The material of which the frame, planes, and propellers will be constructed. Plans received will not be shown to other bidders.

2. It is desirable that the flying machine should be designed so that it may be quickly and easily assembled and taken apart and packed for transportation in army wagons. It should be capable of being assembled and put in operating condition in about one hour.

3. The flying machine must be designed to carry two persons having a combined weight of about 350 pounds, also sufficient fuel for a flight of 125 miles.

4. The flying machine should be designed to have a speed of at least forty miles per hour in still air, but bidders must submit quotations in their proposals for cost depending upon the speed attained during the trial flight, according to the following scale:

40 miles per hour, 100 per cent.
39 miles per hour, 90 per cent.
38 miles per hour, 80 per cent.
37 miles per hour, 70 per cent.
36 miles per hour, 60 per cent.
Less than 36 miles per hour rejected.
41 miles per hour, 110 per cent.
42 miles per hour, 120 per cent.
43 miles per hour, 130 per cent.
44 miles per hour, 140 per cent.

5. The speed accomplished during the trial flight will be determined by taking an average of the time over a measured course of more than five miles, against and with the wind. The time will be taken by a flying start, passing the starting point at full speed at both ends of the course. This test subject to such additional details as the Chief Signal Officer of the Army may prescribe at the time.

6. Before acceptance a trial endurance flight will be required of at least one hour during which time the flying machine must remain continuously in the air without landing. It shall return to the starting point and land without any damage that would prevent it immediately starting upon another flight. During this trial flight of one hour it must be steered in all directions without difficulty and at all times under perfect control and equilibrium.

7. Three trials will be allowed for speed as provided for in paragraphs 4 and 5. Three trials for endurance as provided for in paragraph 6, and both tests must be completed within a period of thirty days from the date of delivery. The expense of the tests to be borne by the manufacturer. The place of delivery to the Government and trial flights will be at Fort Myer, Virginia.

8. It should be so designed as to ascend in any country which may be encountered in field service. The starting device must be simple and transportable. It should also land in a field without requiring a specially prepared spot and without damaging its structure.

9. It should be provided with some device to permit of a safe descent in case of an accident to the propelling machinery.

10. It should be sufficiently simple in its construction and operation to permit an intelligent man to become proficient in its use within a reasonable length of time.

11. Bidders must furnish evidence that the Government of the United States has the lawful right to use all patented devices or appurtenances which may be part of the flying machine, and that the manufacturers of the flying machine are authorized to convey the same to the Government. This refers to the unrestricted right to use the flying machine sold to the Government, but does not contemplate the exclusive purchase of patent rights for duplicating the flying machine.

12. Bidders will be required to furnish with their proposal a certified check amounting to ten per cent of the price stated for the 40-mile speed. Upon making the award for this flying machine these certified checks will be returned to the bidders and the successful bidder will be required to furnish a bond according to Army Regulations, of the amount equal to the price stated for the 40-mile speed.

13. The price quoted in proposals must be understood to include the instruction of two men in the handling and operation of this flying machine. No extra charge for this service will be allowed.

14. Bidders must state the time which will be required for delivery after receipt of order.

JAMES ALLEN,
Brigadier General,

Chief Signal Officer of the Army.
SIGNAL OFFICE

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APPENDIX C-2

SPECIFICATION DEFINITION AND CONTROL

SPACE COMMUNICATIONS SYSTEM

C-2.1 Introduction

A depiction of a theoretical space communication system is shown in figure C-1. In this example, the shaded areas identify the "concept space" for the overall system and its internal subsystems - or that space within which the designer can execute broad conceptual trade-offs to achieve the best solutions. Note that these trade-offs and conceptual alternatives are the responsibility of the systems contractor and integrator, since he is responsible for the overall performance of the entire system. The unshaded areas - the "definition space" - identify the specific performance requirements for the item within that space. The solid lines bounding the shaded areas identify the formal interfaces, the boundaries over which the contractor (or the customer) has defined the performance requirements, and over which he has control. This is not to say that there are no trade-offs inside the solid lines; it's just that such trades must comply with the defined requirements across the interfaces.

C-2.2 Prime Contractor/Subcontractor Interface and Control

In this example, the prime contractor has no control over the detailed design of the subcontracted elements of the system - for example, the power supply within the spacecraft subsystem; he controls it only in terms of how it interfaces with the spacecraft subsystem, and what performance parameters the power supply must meet at that interface in order to support the spacecraft subsystem. On the other hand, the contractor exerts control over the L-Band Antenna within the spacecraft subsystem to successively lower levels in the communication equipment set and the payload group, all the way to the antenna itself.

Perhaps the simplest example of this relationship might be that of the launch subsystem. In the commercial satellite environment of today, Hughes Aircraft is a leading manufacturer of satellites - a space communication system - while McDonnell Douglas manufactures Delta launch systems for such satellites. Hughes might buy the launch system and launch services from McDonnell Douglas if the capability is compatible with the satellite's requirements. If such is the case, the two of them function well together if the interface is clearly and accurately defined and controlled.

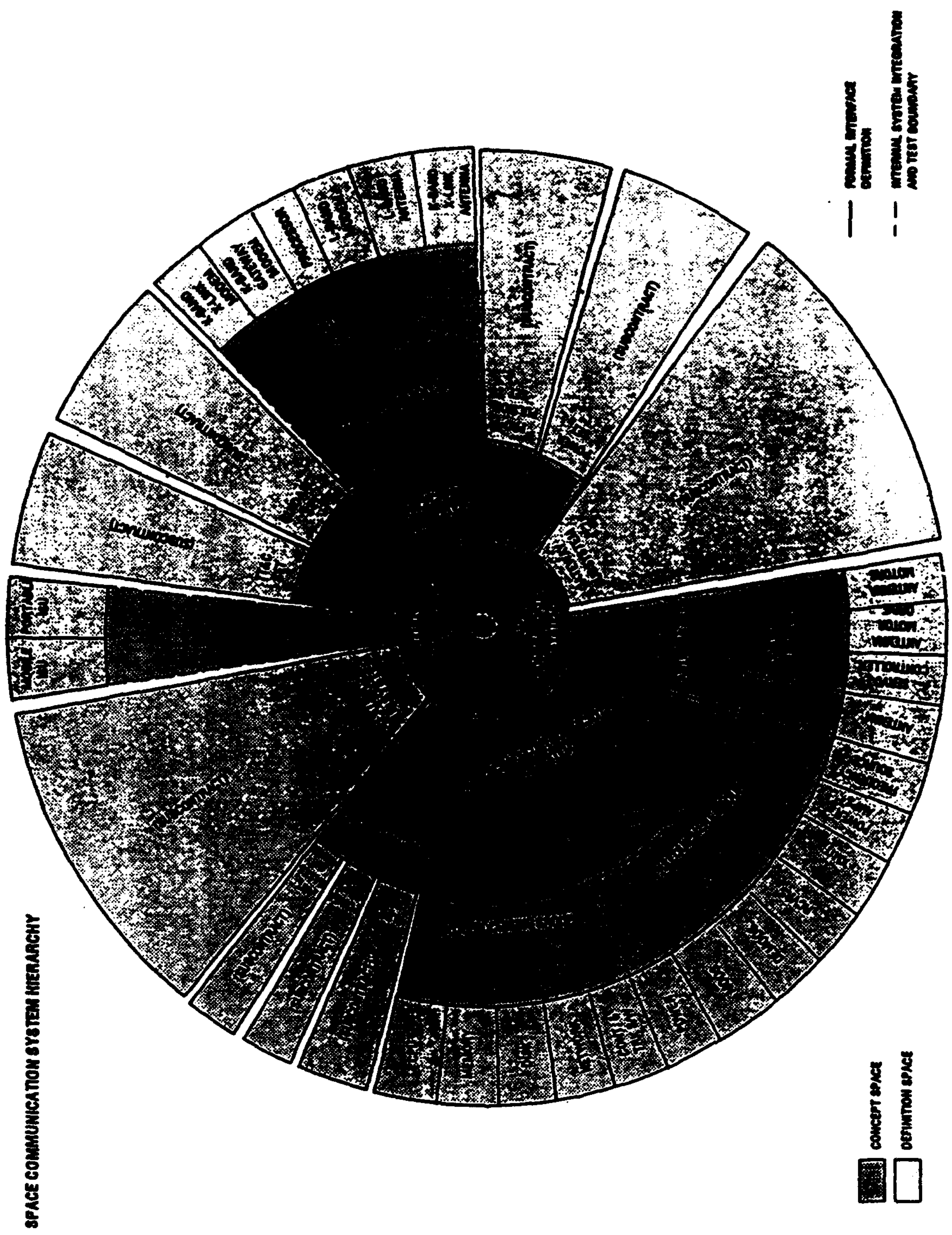

Figure C-1 Specification Control Levels

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APPENDIX C-3

EXAMPLE: USE OF PERFORMANCE SPECIFICATIONS

M109A6 PALADIN SELF-PROPELLED HOWITZER

C-3.1 Introduction

The M109A6 Paladin (figure C-2) is a self-propelled howitzer currently being delivered to the U.S. Army. Unlike earlier versions of the system, the A6 version contains an on-board Automatic Fire Control System (AFCS), which allows the unit to move on the battlefield and deliver fire rapidly, without the need for a external fire location and direction. This "shoot and scoot" capability provides rapid and accurate fire support while minimizing exposure to counterfire through quick repositing.

The Paladin program is more appropriate for today's defense environment, in that it is strictly a modification program from earlier M109A2/A3 versions; there are no new vehicles being constructed from the ground up. In the detailed discussions which follow, however, the application of performance specifications is considered for the entire system as if it was new construction, and the A6 modification program would be a subset of the new system construction effort.

C-3.2 Hardware/Software Work Breakdown Structure

Figure C-3 illustrates a simplified Work Breakdown Structure (WBS) for the Paladin weapon system. At the top level, the system is broken into several major subsystems as shown, including:

- Chassis Assembly
- Cab/Turret Assembly
- Fire control system
- Armament
- Navigation/Comminications
- Basic Issue Items (BII)
- Integration and Assembly

Each of these functional systems could, conceiveably, be procured using a performance specification. The only one which could not easily be segregated is that of Integration and Assembly, since that becomes the item which embodies the delivery of the final system, and would most easily and most completely be performed by the prime contractor. In addition, however, many of the subsystems within each of these higher-level subsystems could also be procured against a performance specification. Some of these items which are most readily apparent are shown in boxes in figure C-3. In actual fact, the Government is not buying many (if any) of these items today against performance specifications.

As far as the Paladin prime contractor is concerned, though, these items can be treated as being procured against performance specifications. This is because they are procured by the Government from other sources, and are provided as Government Furnished Equipment (GFE) to the prime contractor. In the following paragraphs, each of these secondary-level subsystems will be addressed in greater detail.

C-3.3 Chassis Assembly

As noted above, the M109A6 program is a modification program; as such, there is no "full-up" drawing package which defines and describes the construction of an A6 as completely new construction. The last such new-build activities on the M109 were associated with the A2 version. Even so, however, the principles for use of performance specifications are easily evident - and, in fact, are readily compatible with the manner in which the Government procured the A2s. The most readily evident subsystems for which procurement using performance-based specifications could be used are the two boxed items, the engine and the drive system.

The powerplant for the vehicle is a xxx, built by xxx. This engine was (and still is) procured by the Army independent of the end-item M109, and was provided to the prime contractor as GFE. As far as the prime contractor was concerned, the engine was defined by an interface specification and control drawings, and was not under their direct control. The drive system, built by (Allison?), also fits this same category of procuremend.

It should also be noted that there has been a Government division of responsibilities for the M109 system (as there is with most other major systems as well). The hull and its internal subsystems is under configuration management and control of the U.S. Army Tank Automotive Command (USATACOM), while the system and its weapons subsystems are controlled by the U.S. Army Armament, Munitions, and Chemical Command (USAMCCOM). In addition, other systems are controlled by other organizations, for example the navigation system by the U.S. Army Communications and Electronics Command (USACECOM). The net result of this is that the prime contractor functions as the integrator, using systems provided to him as GFE by a number of Army (and Defense) commands.

C-3.4 Cab/Turret Assembly

The cab/turret (i.e., above the turret ring) was manufactured in-house for the M109A2. A new turret for the A6 is also being manufactured in-house. Although this item could be manufactured against a performance specification, it tends to be closely associated wuth the final assembly and integration, and thus becomes an item which logically would remain with the prime contractor. However, many of the subsystems which are contained within the turret could logically be procured using performance specifications. Examples of such subsystems are discussed in the following sections, since similar items are contained within other WBS elements.

C-3.5 Fire Control

The fire control system represents the area of greatest change between the A2/A3 and A6 versions of the M109, since it is the hardware/software of the Automatic Fire Control System (AFCS) which allows the Paladin to deliver accurate fire on targets using its self-contained subsystems. The system also contains the best examples of areas where performance specifications could be applied at successively lower levels of the subsystems.

As shown in figure C-3, the AFCS can be further subdivided into nine major elements, including electronic modules ("black boxes"), tachometers, sensors, and the battery. Each of these (as well as each of the vehicle motion sensors) could be procured against a performance specification, since the interfaces among each of them must be clerly defined and controlled to ensure system performance. In addition, three of the Line Replaceable Units electronic modules (the Display Control Assembly, Communications Processor, and Ballistic Computer/Weapons Controller, shown by the dotted lines) contain circuit boards (MIL-STD-1553 data bus, Central Processor Unit, and Memory cards) which can have wider appliction than just that specific module. Going even one step lower, as illustrated in the box at the lower right, each of these items or Shop Repair Units may contain high-dollar integrated circuits or chips which are also common, and which are procured as catalog items by the contractor.

In addition to the AFCS, the Paladin also incorporates a back-up fire control system, shown at the lower left corner of figure C-3. Most of these items can be procured against performance specifications as well, since they are usually have wider application than a single system, and are provided as GFE to the prime contractor

C-3.6 Armament

The Armament system includes some new production elements such as the cannon and mount as well as items such as the M2 machine gun which has been in production and use for decades. The cannon and mount are produced today by Army arsenals at Watervliet and Rock Island, respectively, and are provided to the contractor as GFE. The M2 machine gun is manufactured by Saco Defense, Inc. (SDI) and provided as GFE as well. None of these items is manufactured today under a performance specification, although they could be; appendix E-2 of this document contains a sample performance specification for a lightweight M60 machine gun, also manufactured by SDI, which maintains all of the performance and interchangeability (backward and forward) requirements of the current system.

C-3.7 Navigation/Communications

As with the Fire Control and Armament systems, most of the Communication and Navigation Systems are not manufactured by the prime contractor, and are provided to the prime as GFE for integration into the system. Although several examples of such subsystems are shown in figure C-3, the SINCGARS radio is of particular interest. The SINCGARS being procured today by USACECOM from two sources (ITT Defense and Electronics and General Dynamics Electronics) presents an identical control panel to the user, but there are two very different designs within the box, Although the radios are not being procured against performance specifications, the "face to the user" is one of appearance and performance only.

C-3.8 Basic Issue Items (BII)

BIIs are, almost by definition, items which have widespread application across a large number of systems, and as such are either procured today against common drawings; alternatively, they may also represent opportunities to use performance specifications for their procurement. BIIs include such items as adapters, socket wrenches, water cans, fuel and water containers, etc.

C-3.9 Integration and Assembly

Integration and Assembly, although standing as a lower-level WBSE, really embodies the prime contractor's performance specification, since this is where the prime contractor "puts it all together" and sells off the system to the Government. In effect, this could become the performance specification for the M109A6.

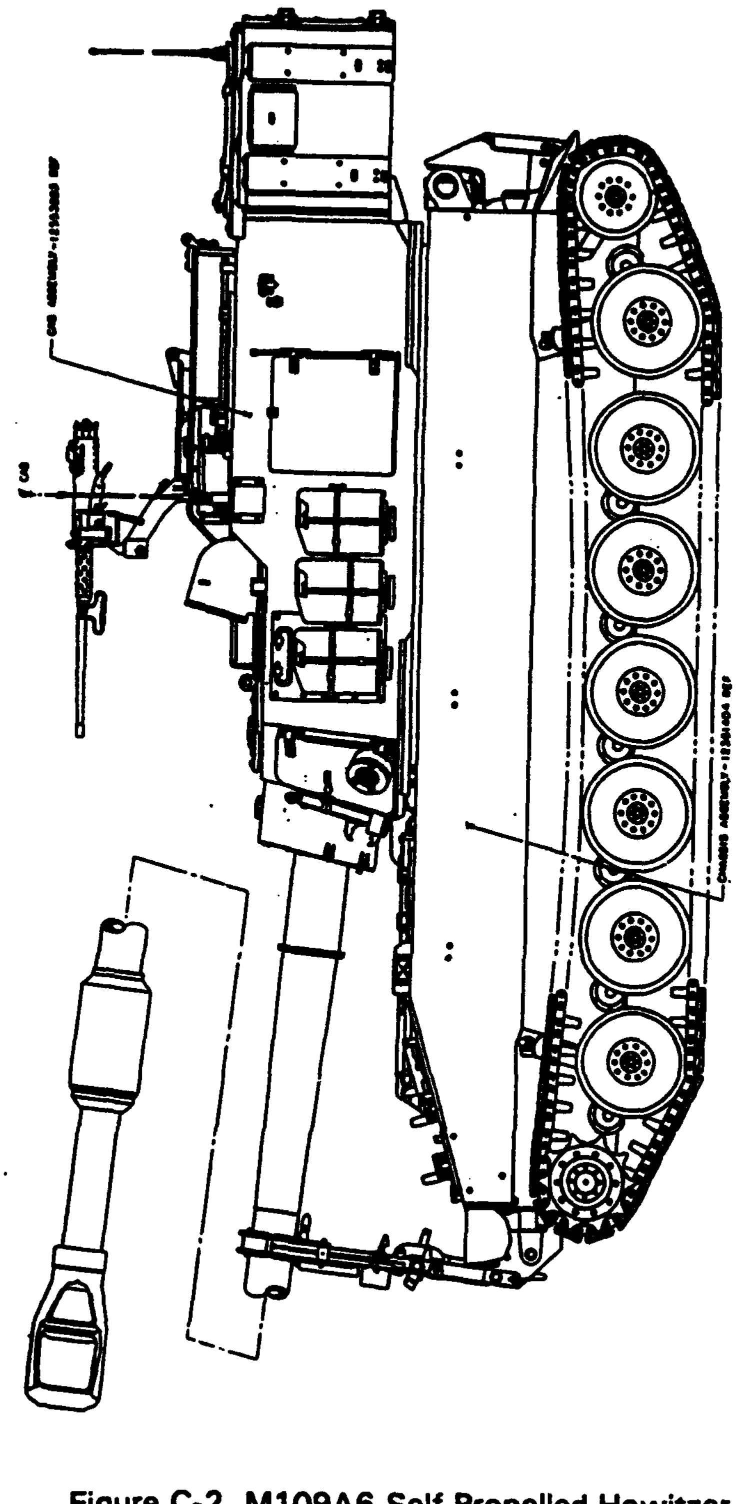

Figure C-2 M109A6 Self-Propelled Howitzer

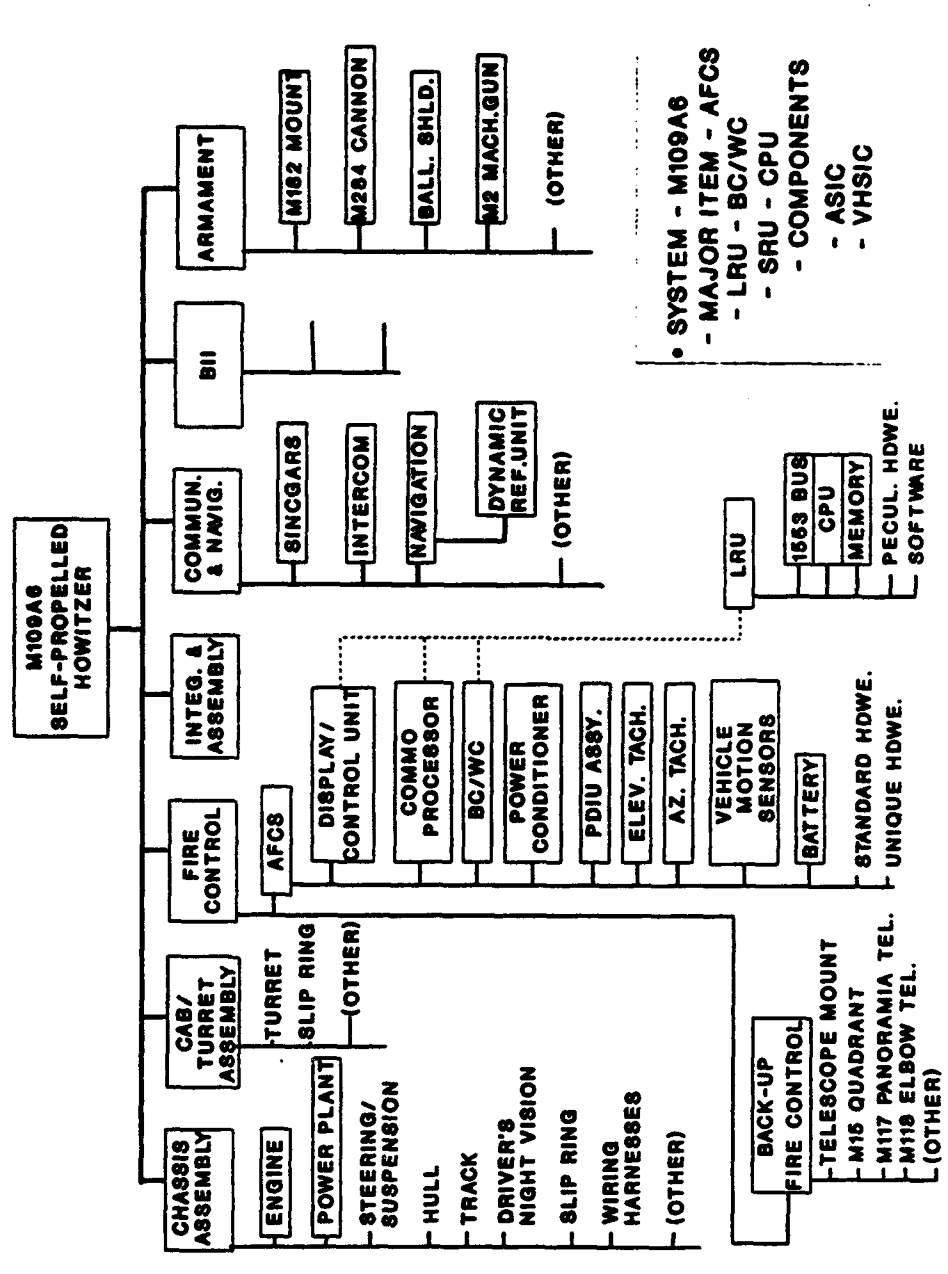

Figure C-3 Simplified Work Breakdown Structure, M109A6

APPENDIX D

FORMAT FOR PRODUCT PERFORMANCE SPECIFICATIONS

FORMAT FOR PRODUCT PERFORMANCE SPECIFICATIONS

SECTION 1 - Scope

1.1 - Scope. The scope shall repeat the item/system name and its modifiers and consist of a clear, concise abstract of the coverage of the specification. It may include details as to the use of the item other than those covered later in the specification. The scope shall not contain any item/system requirements.

1.2 - Classification. This section shall only be used when the specification covers more than one type, grade, or class of items. When used, all included types, grades, and classes of items shall be listed and briefly defined.

SECTION 2 - Applicable Documents

2.1 - Government Documents. This section identifies all government specifications, standards, and handbooks that will form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards and supplement thereto cited in the solicitation. The order of document listing is as follows:

Federal Specifications
Military Specifications
Federal Standards
Federal Information Processing Standards
Military Standards
Military Handbooks

2.2 - Other government documents, drawings, and publications. This section identifies all other government documents, drawings, and publications which will form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation. Of particular interest is the referencing of all drawings (interface, control, top level, etc) which are a part of this specification.

Drawings
Other Government Documents (not listed in 2.1 above)
Publications

2.3 - Nongovernment publications. This section identifies all nongovernment documents which will form a part of this document to the extent specified herein. Examples would be industry specifications or standards.

2.4 - Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

SECTION 3 - Requirements

3.1 - Item/system description. This paragraph shall contain a general description of the functional characteristics of the configuration item which is covered by this specification.

3.2 - Major component list and characteristics. This paragraph shall list all major components which comprise the item/system. It shall include an indentured component/specification tree showing the relationship among the components making up the item/system. This list shall specify to the lowest configuration item level. If the item is a component of a larger item/system the component/specification tree shall also identify the higher level item and specification. Any special component characteristics shall be identified herein.

3.3 - Government-furnished property list. This paragraph shall list the government furnished property which the item/system shall be designed to incorporate. This list shall identify the property by reference to its nomenclature, specification number, and other pertinent identifiers.

3.4 - Characteristics. This paragraph shall state all of the minimum essential needs of the government to satisfy the intended use and application of the item/system. All characteristics stated herein shall be capable of being measured and will be the basis of the quality assurance provisions contained in Section 4 of the specification. Characteristics should state required functions or performance levels, not design or fabrication guidance.

3.4.1 - Performance. This paragraph shall state what the item/system shall do in terms of complete functional and mission characteristics. Upper and/or lower limits for each performance characteristic shall be provided. These characteristics shall be stated as requirements that must be achieved and not as goals or best efforts.

3.4.2 - Physical characteristics. This paragraph shall include the following, as applicable: Overall weight and envelope dimension limits, physical requirements for transport and storage, requirements for operator and maintenance access, and any other appearance factors. If envelope drawings are used to document these characteristics, they shall be referenced here.

3.4.3 - Interface requirements. This paragraph shall cover the functional and physical interfaces between the item/system and any other configuration items (both other complete end-items or other system components within a larger system). All interfaces necessary to ensure compatibility of the item/system with other configuration items must be described. The functional interfaces shall be specified in quantitative terms of inputs/outputs or operational roles. Where interfaces differ due to a change in operational mode, the requirements shall specify the interfaces for each mode. Physical interface relationships shall be expressed in terms of dimensions with tolerances. Generally, physical interface requirements shall be presented in the form of envelope drawings, interface control drawings or assembly drawings, and shall be referenced here.

3.4.4 - Reliability. Reliability shall be started in quantitative terms and must also define the conditions under which the requirements must be met. Minimum values should be stated for each requirement.

3.4.5 - Maintainability. This paragraph shall specify quantitative maintainability requirements such as mean and maximum downtime, mean and maximum repair time, mean time between maintenance actions, the ratio of maintenance hours to hours of operation, limits on the number of people and skill levels required for maintenance actions, or maintenance costs per hours of operation. Additionally, existing government or commercial test equipment used in conjunction with the item must be identified along with the requirement for compatibility between the item and the test equipment.

3.4.6 - Environmental conditions. This paragraph shall state both induced and natural environmental conditions expected to be encountered by this item during storage, shipment, and operation.

3.4.7 - Transportability. This paragraph shall include all requirements for transportability for the overall item and any subcomponents. Identification of transport vehicles/modes shall be included.

3.4.8 - Design, construction, and workmanship standards. This paragraph shall state any necessary military, federal, or industry design, construction, or workmanship standards that must be applied to the design or production of the item. Such requirements should be unique, absolutely necessary for the proper manufacture of the item, and used sparingly. An example would be the need to meet Federal Aviation Authority design and production requirements for aircraft components.

3.4.9 - Materials, processes, and parts. This paragraph shall specify any item unique requirements governing the use of materials, parts, or processes in the design or production of the item. Such requirements should be unique, critical to the successful use of the item, and kept to a minimum. An example would be the mandated use of an existing military inventory item as a component in this new item.

3.4.10 - Identification and marking. This paragraph shall cover requirements for coloring, identification marking, and markings needed for operation and safety of the item. Drawings may be utilized to show marking locations or patterns.

3.4.11 - Interchangeability. This paragraph shall specify the requirements for item and component interchangeability and replacement.

3.4.12 - Safety. This paragraph shall state requirements to preclude or limit hazards to personnel or equipment. Any applicable federal or military safety standards shall be stated here.

3.4.13 - Human performance/human engineering. This paragraph shall state all special human factors issues or limitations. Examples include limitations on operator functions, interfaces, or reaction times.

3.4.14 - Qualification. This paragraph shall state any requirements for item or component qualification testing. Both preproduction and periodic production testing will be addressed. If qualification is required, the following statement shall be used:

> "Qualification. (Item) furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4._ and 6._)."

SECTION 4 - Quality Assurance Provisions

4.1 - General. This paragraph shall, as applicable, provide general information pertinent to tests and inspections not covered elsewhere in Section 4.

4.1.1 - Responsibility for test/inspection. This paragraph shall usually state that the responsibility for performing all specified tests and inspections rests with the supplier, and that the government reserves the right to witness or separately perform any or all tests.

4.2 - Classification of tests.

4.3 - Test/Inspection conditions. This paragraph shall state the environmental conditions under which all tests and inspections shall be conducted.

4.4 - First Article Test (FAT). This paragraph shall state the specific test and inspections which will be required as part of the FAT along with criteria for determining conformance. The contents of this paragraph are only applicable if a requirement to perform a FAT is contained in the contract SOW.

4.5 - Qualification test. When Section 3 of the specification contains a requirement for qualification testing, this paragraph shall describe the testing routine, sequence of tests, number of units to be tested, data required, and criteria for determining conformance.

4.6 - Quality conformance inspection. Every item requirement contained in Sections 3 and 5 of this specification must have a quality conformance test or inspection identified in a following subparagraph. The subparagraph headings should be traceable to the paragraph/subparagraph headings contained in Sections 3 and 5. A comparison matrix may be used to accomplish this. In as much as possible the tests and inspections should only identify the item characteristic(s) to be checked and the acceptable range of values. Specific methods of testing that are design technology dependent should be avoided.

4.6.1 - Performance
4.6.2 - Physical characteristics
4.6.3 - Interface requirements
4.6.4 - Reliability
4.6.5 - Maintainability
4.6.6 - Environmental conditions
4.6.7 - Transportability
4.6.8 - Design, construction, and workmanship standards
4.6.9 - Materials, processes, and parts
4.6.10 - Identification and marking
4.6.11 - Interchangeability
4.6.12 - Safety
4.6.13 - Human performance/human engineering

SECTION 5 - Packaging

5.1 - Preparation

5.1.1 - Preservation. This paragraph shall identify any requirements for application of protective measures such as cleaning, drying, preservatives, unit packs, wrapping, cushioning, blocking, bracing, or intermediate containers.

5.1.2 - Packing. This paragraph shall state requirements for blocking, bracing, and cushioning of external shipping containers. Packing or packaging drawings may be utilized to describe these requirements. If used, such drawings must be cited here.

5.1.3 - Marking. This paragraph shall state any requirements for packaging or container marking for transport and storage. Applicable military and federal standards/specifications shall be stated herein.

SECTION 6 - Notes (non-contractually binding)

APPENDIX E-1

COMPARISON

TDP vs. PERFORMANCE SPECIFICATION

SPECIFICATION	OLD PRACTICES	NEW PRACTICES
	Section 2 - Applicable Documents	
1. Order of Precedence	Product drawings take precedence over specification	Specification takes precedence over all other documentation
2. Tiering and flowdown	Large amount of specification tiering and flowdown in most specifications	Excluded unless necessary to define system performance requirements
3. Administrative specifications and standards	Frequently contained within specifications in addition to product-related requirements	Specifications limited to user requirements. Contract data excluded.
	Section 3 - Requirements	
1. First Article requirements	Often defined in specification <u>and</u> in contract	Not included in specification; defined as part of contract requirements as necessary
2. Material and construction requirements	"How To" frequently included in Section 3	Not included; Section 3 limited to defining performance requirements
3. Detailed fabrication and assembly requirements	"How To" frequently included in Section 3	Not included; Section 3 limited to defining performance requirements
4. Undefined design requirements on specific parts	Requirements frequently include vague design requirements without defining quantitative conformance criteria	Design requirements are provided where necessary for interface and interoperability. All other design criteria are defined only in terms of performance.

SPECIFICATION	OLD PRACTICES	NEW PRACTICES
5. Test methods	Refers to specific test requirements of Section 4. Defines how tests are to be performed.	All references to Test Methods in Section 3 are deleted.
6. Operating characteristics for individual component parts	Frequently included without quantifiable criteria	Defines operational interfaces and interchangeability requirements
	Section 4 - Quality Assurance Provisions	
1. Responsibility for inspection and test	Lengthy discussion of inspection and test responsibilities	Assigns responsibility for all inspection & test to contractor
2. First Article inspection and test	Detailed First Article Inspection and Test requirements defined	Not included in specification; defined as part of contract requirements as necessary
3. Definition of inspection and test procedures/equipment	Fully defines test condition for each requirement defined in Section 3	Classification of tests only, i.e., 100% acceptance, sampling, reliability, or Initial Production (IPT). Defines environmental conditions for tests.
	Section 5 - Packaging	
1. Inclusion of detailed preservation, packing, and packaging design	Often defines specific military packaging and protection requirements	Encourages use of commercial practices where more adverse Government requirements are not defined, necessary, or required by the Government

SPECIFICATION	OLD PRACTICES	NEW PRACTICES
	Section 6 - Notes	
1. Contract data requirements and procurement instructions	Requirements are frequently included in Section 6, in addition to the Contract Data Requirements List (CDRL) and other contractual requirements	Deleted entirely. Requirements are contained in the contract.
2. Inspection equipment design and approval requirements	Imposes detailed requirements and controls over Inspection and Test equipment	Deleted - this is properly a contractor responsibility
3. Technical Data Package (TDP)	Refers to Government-controlled TDP that takes precedence (see Section 2 discussion above)	The TDP is maintained and controlled by the contractor. At any time, it defines the system being produced by the contractor, and forms the basis for reprocurement.
4. Test Facilities	Often defined within the specification	Not defined - contractor responsibility
5. MIL-Q-9858 and MIL-I-45208	Often defined as a product specification requirement	Not defined - contractor responsibility
6. Government disclaimer	Government often tries to limit its responsibility regarding specification changes	Government must assume responsibility for changes to performance specifications

APPENDIX E-2

PERFORMANCE SPECIFICATION

MACHINE GUN, 7.62MM: M60E4

21 September 1993

PERFORMANCE SPECIFICATION
MACHINE GUN, 7.62MM: M60E4

1. SCOPE

1.1 Scope. This specification covers one type of 7.62 millimeter (mm), self-powered, gas operated, air cooled, link belt fed, lightweight machine gun furnished with one spare interchangeable barrel assembly with carrying handle. The machine gun is capable of being fired from either the hip, shoulder, standing, sitting, or prone position by use of the bipods, tripod, or pedestal mount. The machine gun is capable of automatic fire of belted 7.62mm NATO ball ammunition (MIL-L-45403 links and MIL-C-46931 ball ammunition). The M60E4 is capable of being employed and serviced in accordance with the applicable Operator's Manuals and Technical Manuals.

2. APPLICABLE DOCUMENTS

2.1 Specifications and Standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MIL-L-45403	-	Link, Cartridge, Metallic Belt, 7.62mm, M13
MIL-L-46000	-	Lubricant, Semi-Fluid (Automatic Weapons)
MIL-L-63460	-	Cleaner, Lubricant and Preservative: (CLP) - Break Free
MIL-C-46477	-	Cartridge, 7.62mm, NATO, Test, High Pressure, M60
MIL-C-46931	-	Cartridge, 7.62mm, NATO, Ball, M80
MIL-B-60107	-	Bandoleer, M4

2.1.2 Other documents, drawings and publications. The following other documents, drawings and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be those in effect on the date of solicitation.

* Drawings

SA5192	M60E4 Machine Gun
SB4956	Headspace Test Requirements Drawing
C7269214	Targeting and Accuracy Drawing

2.2 Order of Precedence. In the event of a conflict between the text of this specification, the product drawings and the references cited herein, the text of this specification shall take precedence, followed by the product drawings, and then the cited references.

3. REQUIREMENTS

3.1 Design Characteristics.

3.1.1 Physical Characteristics. The M60E4 machine gun shall weigh 19.5 +/- .2 lbs with standard barrel and 19.2 +/- .2 lbs with short barrel. The M60E4 envelope dimensions shall be in accordance with envelope drawing SF5193. The M60E4 barrel bore shall be rifled and chambered to fire standard NATO 7.62mm ammunition, and the rifling twist shall be 1 turn in 12 inches. All M60E4 components shall be manufactured of corrosion resisting materials, or shall be coated so as to resist corrosion. All exterior surfaces of the machine gun shall be non-reflective.

The M60E4 machine gun shall be easily field stripped as described in the applicable Operator's Manual. The M60E4 gun assembly shall conform to drawing SA5192.

3.1.2 Interface Requirements. The M60E4 machine gun shall be compatible with and shall function properly when used in conjunction with the following equipment:

Mounts

M122 Tripod with M60 Platform Adapter
M122 Tripod with M60 Pintle Assembly
M122 Traverse and Elevating Mechanism
MK64 Mount with M60 adapter

Ancillary Equipment

AN/PVS-4 Night Sight with M60 Adapter mount
MK 164 MOD 0 Blank Firing Attachment

Ammunition

M60 Armor Piercing ammunition
M80 ball ammunition
M62 Tracer ammunition
M63 Dummy ammunition
M82 Blank Ammunition

3.2 Performance.

3.2.1 Functioning. Machine guns shall operate with Government standard 7.62mm, M62 Tracer and/or M80 ball cartridges and 7.62mm, M13 links without malfunctions or unserviceable parts, and the cyclic rate of fire shall be within 500 to 650 rounds per minute when fired from a fixed firing stand, and with a 100-round belt of ammunition hanging unsupported in a vertical position from the firing stand feed tray. The 100-round belt of ammunition shall have a dummy inert cartridge separating each twenty rounds of the belt.

3.2.2 Targeting and accuracy. Using Government standard 7.62mm, M80 ball cartridges and 7.62mm, M13 links, nine rounds of a 10 round burst fired from the machine gun at a range of either 50 yards or 100 yards shall be within the extreme spread and targeting area specified on drawing C7269214 for the applicable range. The machine gun shall be capable of meeting the above requirements with both assigned and spare barrels, using the same rear sight setting.

3.2.3 Headspace. The headspace in the assembled gun, with both the assigned and spare barrels, shall be not less than 1.6315 inch and not more than 1.6365 inch when measured to the 0.400 diameter datum on the first shoulder of the chamber.

3.2.4 High pressure resistance. Machine guns shall be capable of withstanding the firing of a Government standard 7.62mm M60 high pressure test cartridge (MIL-C-46-477). Parts shall be free of cracks, seams, and other injurious defects after proof firing as evidenced by visual and magnetic particle inspection.

3.2.5 Interchangeability. Unless otherwise specified on the drawings, the parts listed in Table I shall be interchangeable.

3.2.6 Endurance. Machine guns shall be capable of firing 10,000 rounds of Government standard 7.62mm, M80 ball cartridges, when mounted in a fixed firing stand, without incurring more than three immediately clearable malfunctions, and the cyclic rate of fire shall be within limits specified in 3.3.1. No unserviceable parts, uncontrolled fire or malfunctions which require disassembly of the machine gun and/or in excess of one minute to correct are allowed. A malfunction is defined as any unplanned cessation in firing or the inability to commence firing.

3.2.7 Firing pin indent. The firing pin indent on a standard copper compression cylinder shall be not less than 0.030 inch and shall not be off center more than one-half the diameter of the firing pin indent.

3.2.8 Trigger pull. The trigger pull, when tested on a cocked weapon, shall be free of creep and shall be greater than 6 pounds but shall not exceed 11.5 pounds. Creep shall be interpreted to mean any perceptible rough movement between the time the trigger slack is taken up and the sear is disengaged from the operating rod.

3.2.9 Reliability. The M60E4 machine gun shall demonstrate a minimum Mean Round Between Stoppage (MRBS) of 910 rounds and a minimum Mean Rounds Between Failure (MRBF) of 3860 rounds when fired from a fixed firing stand. Receiver life shall be 50,000 rounds minimum. Barrel Life shall be 15,000 rounds minimum. A barrel is considered unserviceable when: (a) 20 per cent of any burst exhibits yaw of 15 degrees or more, or (b) a mean velocity of a burst drops 200 feet per second below the mean of the velocity initially recorded at the start of the test. Barrels failing to meet the minimum life criteria shall be considered failures for the MRBS/MRBF computations. Reliability testing shall only be performed when required by contract. Reliability testing shall be performed on three (3) weapons.

3.2.10 Operating Environment. The M60E4 machine gun shall be capable of operating in the same extreme environmental conditions (i.e., hot, cold, sand, dust, corrosive environment) as the standard M60 machine gun.

3.4 Identification and Marking. Each Receiver shall be marked with a unique serial number as authorized by the U.S. Government.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Test/Inspection.

Unless otherwise specified in the contract or purchase order, the supplier is responsible for performance of all inspection and tests.

4.2 Classification of Tests.

The tests described in this specification are categorized in four groups as follows:

A Unit Acceptance Testing; This testing is performed on every unit as part of product acceptance testing. This testing includes Function Firing, Targeting, and Accuracy, Headspace Testing, and High Pressure Resistance Testing.

B Sample Acceptance Testing; This testing is performed on sample product to verify conformance on a periodic basis. Sample testing includes Interchange, Endurance, Firing Pin Indent Testing, and Trigger Pull Testing.

C Reliability Testing; This testing consists of life cycle tests to verify conformance to Mean Rounds between Fire and Mean Rounds Between Stoppage requirements. This testing is conducted at room temperature, and with proper lubrication and cleaning schedules. Reliability testing is required when a manufacturer is producing the weapon for the first time, and on a periodic basis as specified in the Contract.

D Initial Production Testing (IPT); This testing consists of firing the weapon(s) under severe environmental conditions such as hot/cold, salt water, sand & dust, and mud. This test is required when a manufacturer is producing the weapon for the first time.

4.3 Test/Inspection conditions. All Unit Acceptance Testing, Sample Acceptance Testing, and Reliability Testing shall be performed at ambient temperature.

5.0 PACKAGING

5.1 Preservation, Packing, and Marking. Machine guns with equipment shall be preserved, unit packaged, packed, and marked in accordance with standard commercial practice to the level of protection specified in the contract and as required to protect the hardware during transit and in storage.

6.0 NOTES

6.1 The Technical Data Package (TDP) that provides the detailed configuration of the M60E4 machine gun is provided to the contractor on an informational basis. The contractor can make changes to the TDP provided the changes do not increase contract cost or adversely affect the requirements contained in Section 3 of this specification. The contractor is responsible for maintenance of the TDP on a continuing basis, and all products manufactured by the contractor must comply with the contractor-maintained TDP.

Table I. List of Interchangeable Parts

-Actuator Assembly, Cam
-Barrel Assembly with Carrying Handle with gas cylinder extension assembly and locknut removed
-Bearing, firing pin
-Clip, spring lever
-Sling Swivel assembly
-Cam assembly, Feed
-Gas Cyl. Ext Assy.
-Plunger, Safety
-Receiver Assy
-Safety (Right Side)
-Locknut, Gas Cylinder
-Extractor
-Guide, drive Spring
-Handle Assy, Cocking
-Housing Assy, Cover
-Spring, Helical, torsion (used with feed lever assy)
-Housing Assy, Trigger
-Rod Assy, Operating
-Shaft, Ctg Guide
-Shaft, Ctg Pawl
-Spring, Firing Pin
-Spring, Helical, Compression (use with Extractor Plunger)
-Forward Grip Assembly
-Buffer Assy
-Guide, Ctg, Front
-Guide, Cocking Handle
-Lever, Feed
-Spring, Helical, Compression (used with sear plunger)
-Latch, hinge pin
-Yoke, Buffer retaining
-Trigger Assy
-Heat Shield
-Bandoleer, hanger assembly
-Pin, hinge cover
-Plunger, Extractor
-Sear
-Spring, Driving
-Bipod assembly
-Guide, Ctg, rear
-Pawl assembly, feed
-Pawl, Ctg retainer
-Pin, firing
-Pin, retaining
-Spring, Helical, Compression (used with Barrel lock)
-Bolt
-Plunger, Sear
-Safety
-Spring, Helical, Torsion (use with ctg feed tray assy)
-Spring lock, retaining pin
-Stock Assy, Butt
-Lock Barrel
-Pin, Straight, Headless (used with Bolt Plug Assy)
-Pin, Shoulder, headed (used with Trigger [illegible]sy)
-Piston, gas
-Plug Assy, Bolt
-Frame Assy, Ctg tray
-Cap, retaining (used with barrel lock)
-Spring, helical, compression (used with safety plunger)
-Spring, helical, torsion (used with Cover assy)

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APPENDIX E-3

COMPARISON

TDP-BASED SPECIFICATION

versus

PERFORMANCE SPECIFICATION

7.62mm M60 MACHINE GUN

NUMBER OF PAGES BY SPECIFICATION SECTION

SPECIFICATION SECTION	TDP-BASED SPECIFICATION PAGES	PERFORMANCE SPECIFICATION PAGES
1. SCOPE	½	≈ ½
2. APPLICABLE DOCUMENTS	2	1
3. REQUIREMENTS	8*	4
4. QUALITY ASSURANCE PROVISIONS	18½*	1
5. PACKAGING	½	≈ ½
6. NOTES	3½	-
TOTAL	33	7

* Each of these sections directly references a large number of component, test, and/or inspection equipment drawings (both MIL- and system-peculiar) which are not included in the specification itself.

GLOSSARY

ADPA	American Defense Preparedness Association
AFCS	Automatic Fire Control System
AMC	U.S. Army Materiel Command
AMCP	Army Materiel Command Pamphlet
ANSI	American National Standards Institute
APU	Auxiliary Power Unit
AQL	Acceptable Quality Level
ASA(RDA)	Assistant Secretary of the Army for Research, Development and Acquisition
ASD	Assistant Secretary of Defense
ASQC	American Society for Quality Control
BII	Basic Issue items
CDRL	Contract Data Requirements List
CI	Configuration Item
CM	Configuration Management
COC	Certificate of Conformance
CPI	Continuous Process Improvement
CRAG	Corporate Risk Assessment Guide
DCAA	Defense Contract Audit Agency
DCMAO	Defense Contract Management Administrative Office
DCMC	Defense Contract Management Command
DOD	Department of Defense
DODI	Department of Defense Instruction
DPRO	Defense Plant Representative Office
DRAM	Dynamic Random Access Memory
DTIB	Defense Technology Industrial Base
ECP	Engineering Change Proposal
EF	Exemplary Facilities
FAR	Federal Acquisition Regulations
FAT	First Article Test

FCA	Functional Configuration Audit
FOT&E	Follow-On Test and Evaluation
GAO	General Accounting Office
GFE	Government Furnished Equipment
HAZMAT	Hazardous Materials
ILS	Integrated Logistics Support
IPT	Initial Production Testing
ISO	International Standards Organization
JSOR	Joint Statement of Operational Requirements
LORA	Level of Repair Analysis
LRU	Line Replaceable Unit
LSA	Logistics Support Analysis
LTPD	Lot Tolerance Percent Defective
MANPRINT	Manpower and Personnel Integration
MIL-SPEC	Military Specification
MIL-STD	Military Standard
MN	Materiel Need
NDI	Nondevelopmental Item
O&S	Operating & Support (Cost)
ODC	Oxygen-Depleting Chemicals
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OTA	Office of Technology Assessment (Congressional)
PBA	Performance Based Acquisition
PBC	Performance Based Contracting
PCA	Physical Configuration Audit
PEO	Program Executive Officer
PM	Program Manager
PPS	Product Performance Specification
QA	Quality Assurance
QAP	Quality Assurance Provisions
R&D	Research and Development
RAM	Reliability/Availability/Maintainability
RBM	Readiness Based Maintenance

RFP	Request For Proposal
ROC	Required Operational Capability
S/SDB	Small/Small Disadvantaged Business
SFDLR	Stock Funding of Depot-Level Reparables
SOW	Statement of Work
STA	Sparing to Availability
TAV	Total Army Visibility
TDP	Technical Data Package
TEMP	Test and Evaluation master Plan
WBS	Work Breakdown Structure

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