

Exercise on Performance Requirements

LESSON ASSIGNMENT SHEET

Lesson Number	DSW-03
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Lesson Title	Exercise on Performance Requirements
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Lesson Time	2.00 Hours
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Lesson Overview	This exercise consists of a short review of applicable content and three parts: Part A is focused on determining whether a requirement would be allowed in a Performance Specification; Part B is focused on determining whether a set of requirements represent a Performance Specification or a Detail Specification; and Part C is focused on rewriting a Detail Specification as a Performance Specification.
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Terminal Learning Objective	When provided with a requirements document, the student should be able to correctly classify the document as a Performance Specification or a Detail Specification and convert detail, design requirements into requirements appropriate for inclusion in a performance specification.
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Enabling Learning Objectives	<ul style="list-style-type: none"> • Identify the distinction between performance and non-performance requirements. • Rewrite detail requirements as performance requirements. • Identify the differences between Performance Specifications and Detail Specifications. • Identify the intended performance characteristic from a detail design solution. • Differentiate between specification requirements and contract requirements.
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Exercise on Performance Requirements

- Assignments**
- READ: Teaching Note “Stating Requirements” (pages 03-3 through 03-9)
 - SCAN: “Exercise on Performance Requirements” VUGRAPHS (pages 03-VG-1 thru 03-VG-)
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Assessment Application Exercise/Student Participation

- Related Lessons**
- DSW-05
 - DSW-09
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- Self Study
References**
- DoD 4120.24-M.
 - SD-15: Performance Specifications
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TEACHING NOTE**Stating Requirements****1. INTRODUCTION.**

a. Because of changes in the international and domestic political environments, the Department of Defense budget has been dramatically reduced since the mid-1980's. To compensate for the reduced funding available, the DoD has instituted significant changes in the acquisition process to optimize the use of the available resources. One of the primary efforts towards achieving this goal has been a renewed emphasis on the use of performance requirements in contracting and in defining the users' needs.

b. Although the Federal Acquisition Regulation (FAR) recognizes that requirements may be expressed in terms of function to be performed, performance necessary to accomplish that function, or as a design that will deliver the required levels of performance, the FAR emphasizes the use of performance requirements in stating the Government's needs. Current Federal and Department of Defense policies require that requirements be based upon the users' needs and market research data. In addition, to the greatest extent possible, requirements shall be expressed in terms which will allow offerors to propose existing commercial products. For the purposes of this lesson the term "performance requirements" is used generically to include both function and performance requirements.

c. Whether the Government's needs are stated as design or performance requirements, there are certain rules which apply:

- Requirements are stated using the word "shall".
- The requirement must be possible to accomplish.
- Requirements must be verifiable and free from ambiguity.
- Requirements are based upon the users' needs and market research, not upon a particular product or model.
- Requirements shall permit full and open competition.
- Requirements shall not include any restrictive provisions except as authorized by law.

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Generally, the requirements imposed in a product description are derived through the systems engineering process. In systems engineering, the function of an item is decomposed into the various performance elements which are necessary to accomplish the required function. The performance elements are then analyzed and a design approach selected which, when completed, will result in a final product design which will provide the required levels of performance in mission accomplishment. The systems engineering process is an iterative process which breaks down the end use in a step-wise fashion to the lowest component design. It must be remembered that the design of a product is done from the top down, but the fabrication of the product is done from the bottom up. In order for a product to be manufactured, a detailed design solution is required. What has changed in DoD acquisition is the level to which DoD will control the design. The current approach is that DoD will use performance specifications to the greatest extent possible for the acquisition of new systems.

d. Both performance and design requirements have benefits, challenges, and limitations. The needs for a particular acquisition will determine the applicability of each of these types of requirements in expressing the Government's needs.

2. SYSTEMS ENGINEERING.

a. Systems engineering is an integrated approach used in the development of new products and the evolution of new materiel being developed to satisfy a specific need. The systems engineering process takes an item from an identified function or need to a detailed design solution which is used in the production of products that satisfy the identified function. This is done by the iterative decomposition of the system or product into its components. There are eight Technical Processes that are applied during each iteration of the systems engineering process: Stakeholder Requirements Definition, Requirements Analysis, Architecture Design, Implementation, Integration, Verification, Validation, and Transition. For the purposes of this discussion on stating requirements, we will focus on the first three technical processes, namely Stakeholder Requirements Definition, Requirements Analysis, and Architecture Design. In addition, there are various tools available, collectively called Technical Management Processes, which are used to evaluate the progress of the systems engineering process.

b. The first step in systems engineering is Stakeholder Requirements Definition. During this step, the need is examined and dissected to assure that all aspects of the product's use are clearly understood. Within the DoD this entails meeting with the user to assure a mutual understanding of the product's intended use, operational environment, and all physical, functional, and human factors interfaces.

c. After the product's requirements are clearly defined, the next step in the systems engineering process is Requirements Analysis. Each requirement is broken down into its functional elements and these are then analyzed to determine what must happen, for the

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product to serve its intended use; survive its operational environment; and satisfy its physical, functional and human factors interfaces.

d. Once the Requirements Analysis has been completed, the Architecture Design step of systems engineering process is performed. During Architecture Design, a design solution is developed which addresses all of the requirements, including supportability, which are necessary for the product to perform its intended functions.

e. This process is repeated, going from system to sub-system; from sub-systems to components; and from components to piece parts until a final detail design solution, suitable for manufacturing, is generated. This detailed design represents one of possibly many solutions which will satisfy the users' needs.

f. Historically, DoD had been an active participant in the systems engineering process, in some cases to the extent that DoD dictated the final design solution. However, under the current acquisition environment, the contractor is usually responsible for developing and controlling the detailed design solution based upon inputs from the Government during the Stakeholder Requirements Definition and Requirements Analysis steps of the systems engineering process. Emphasis is placed on outcomes rather than on how that outcome is derived.

3. PERFORMANCE REQUIREMENTS.

a. Definition. Generically, performance requirements state "what is required" but not "how to meet the requirement". For services, a performance requirement would indicate what needs to be accomplished, including the level of accomplishment, without providing a prescribed manner of accomplishing the work. For supplies, a performance requirement states what a product does without providing a product design solution which provides the intended function. In other words, performance requirements describe the functional attributes (e.g., reliability, lethality, compatibility, corrosion resistance) of a product.

b. Benefits. The primary benefit of performance requirements is their flexibility. Rather than directing a specific solution to provide functionality, performance requirements allow each offeror to develop independent approaches to provide the required level of performance. For supplies, this allows manufacturer's to propose their existing products manufactured on existing production lines and to incorporate enhancements and new technology into their products and processes. Because of the inherent flexibility of performance requirements, they generally only need to be revised to reflect changes in the users' needs, and not to reflect new technology or product enhancements. For services, the use of performance requirements allows innovative approaches which may result in more effective and efficient accomplishment of the work. All of these benefits should result in increased competition and lower costs for the same or higher quality products.

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c. Challenges. The three main challenges in using performance requirements are: assuring logistics support for supplies; verification; and assuring that requirements are verifiable without being restrictive.

Because of the variety of solutions that performance requirements afford, the availability of replacement and repair parts must be considered in developing both an acquisition strategy and the product requirements. In addition, interchangeability and interoperability characteristics can be difficult to describe and demonstrate using only performance requirements. The use of long-term warranties and contractor responsibility for logistics support obviate the need for the Government to maintain a detailed Technical Data Package for every item in the DoD inventory.

A requirement is valid only if its presence or absence can be verified. Because of the types of characteristics that performance requirements describe (characteristics like reliability, material compatibility, corrosion resistance, and use in a specific application and environment), verification of performance requirements can be lengthy, complex and expensive. Unique test procedures may have to be developed to demonstrate the requirement in its operational environment and detailed test procedures are often required to eliminate testing bias in product evaluation. The judicious use of qualification or first article test criteria during production can help reduce the inspection burden that performance requirements can engender.

Physical interfaces are very difficult to describe in performance terms without referencing the detailed design of the mating part. For instance, how can the interface between a bolt and a nut be described without referring to the thread characteristics of one of the parts? Even when the interface can be easily described in performance terms, for instance “The widget shall fit into the trunk of a Lincoln Towncar.”, the item designer must refer back to the detailed design of the mating part to determine the design limits. Using performance requirements it can be difficult to include every possible contingency (for instance “The gadget shall be free from material defects.”) without incorporating subjectivity or ambiguity. Some of these challenges can be addressed by using clear and explicit acceptance criteria in the verification section.

d. Applicability. Performance requirements are always applicable provided the requirement is based upon the users’ needs and assures that these needs will be satisfied without being either restrictive or ambiguous.

4. DESIGN REQUIREMENTS

a. Definition. Design requirements impose “how to” direction about a product or service. For services, design requirements describe how the work is to accomplished. For supplies, design requirements describe the physical attributes (e.g., length, weight, color) of the product being described.

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Design requirements are the end product of the systems engineering process and are necessary for the fabrication of products. There are two broad categories of design requirements: those which are necessary for the form, fit and function of the product; and those which are associated with the selected design approach. The first category consists those characteristics associated with the mission or function of the item such as interface requirements. All other characteristics, fall into the second category. The distinctions between these two categories will become more obvious when we discuss Performance Specifications.

b. Benefits. Design requirements have the following benefits: they are usually easy to verify; parts and construction are defined which facilitates acquisition of replacement and spare parts; and the detailed design provides promotes product uniformity.

Design requirements can typically be verified using commonly available inspection equipment and fairly simple examinations. This ease of inspection can reduce production times and lower costs.

When parts fail unexpectedly, the availability of a detailed design can facilitate procurement of replacement or repair parts. Despite the best efforts of the systems engineering process and the testing performed during product development, operational use of a product may uncover the need to perform unplanned repairs and maintenance. When the DoD has a detailed Technical Data Package, each component and piece part is described in suitable detail for production. This allows the DoD to procure the replacement items without a major reverse engineering effort.

By describing the product, or work, in sufficient detail to be repeatable, design requirements inherently foster uniformity.

c. Challenges. The greatest challenge with design requirements is to be explicit without being restrictive. By their very nature, design requirements are oriented towards a specific solution rather than the users' needs. This restrictiveness can cause manufacturers to create DoD-unique products and production lines, despite the fact that they may already have products and processes which will satisfy the users' needs. As new technology becomes available, the design requirements must be updated if these enhancements are to be included in the product. When developing design requirements, there is a tendency to describe a particular model or solution.

Federal and DoD policy state that requirements are to be based on the users' need and shall not be restrictive. This is intended to promote competition and the acquisition of commercial items, thereby reducing cost. This policy can be difficult to adhere to when using design requirements.

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Particularly when used for services, design requirements have a tendency to cause tunnel vision. When tunnel vision occurs, emphasis is placed on how the work is performed (or the product made) rather than on what is accomplished during the work effort. This limits innovation and makes the Government responsible for the success or failure of the effort.

d. **Applicability.** Design requirements are only applicable when exact item uniformity is required, or if the performance requirements cannot adequately assure that the users' needs will be satisfied.

5. PERFORMANCE SPECIFICATIONS

a. A performance specification is a specification that states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. A performance specification defines the functional requirements for the item, the environment in which it must operate, and interface and interchangeability characteristics.

b. Commercial Item Descriptions, Guide Specifications, Defense Performance Specifications, and Program-Unique Performance Specifications all meet the definition for Performance Specifications. Commercial Item Descriptions and Guide Specifications prepared in accordance with their format and content guides are Performance Specifications based upon their allowable content.

c. The inclusion of any design requirements that are associated with a specific design approach will make a document a Detail Specification. Design requirements that are necessary for interface or interchangeability will be allowed in a Performance Specification, but not those design requirements that reflect a particular design approach. In determining whether a document is a Performance Specification, reviewers should challenge the inclusion of any design requirements as to why they are essential to the users' needs. Justification for these requirements must be based upon the users' needs and market research demonstrating that the requirement is the only possible solution that will satisfy those needs.

d. There will continue to be instances where a high degree of uniformity and detailed design requirements are required to satisfy the users' needs (for example, unit insignia). In those instances the use of a Detail Specification will be required.

6. SUMMARY

The proper use of performance and design requirements has a significant impact on the effectiveness of an acquisition. Except in those instances where product uniformity is required to assure that the users' needs will be satisfied the use of performance

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requirements is appropriate and mandated by Federal and Department of Defense policies.

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NOTES

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EXERCISE ON PERFORMANCE REQUIREMENTS



OBJECTIVES

- Identify the distinction between performance and non-performance requirements.
- Rewrite detail requirements as performance requirements.
- Identify the differences between Performance Specifications and Detail Specifications.
- Identify the intended performance characteristic from a detail design solution.
- Differentiate between specification requirements and contract requirements.

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REQUIREMENTS

- Requirements are based on users' needs and market research
- Specifications and standards describe technical requirements
 - Administrative requirements belong in the contract
- State requirements in definite terms free of ambiguity (i.e., there must be a definitive basis for acceptance)
- Requirements must be legal and possible to accomplish
- Requirements are specified with "shall"

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METHODS OF STATING REQUIREMENTS

Function

Performance

Design

Combination

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FUNCTION REQUIREMENTS

- Stated in terms of mission or operational needs
 - “...shall detect and defeat threat aircraft which utilize stealth technology.”

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PERFORMANCE REQUIREMENTS

<ul style="list-style-type: none">• Characteristics describing what the item or system will do - not how performance is achieved<ul style="list-style-type: none">– Capacity– Speed– Strength– Etc	<ul style="list-style-type: none">• Usually promote competition and reduce cost• Permits continued product improvement• Usually requires fewer revisions• Places design responsibility on contractor
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DESIGN REQUIREMENTS

- Characteristics providing a detailed design solution as to how to obtain performance
 - Color
 - Materials
 - Manufacturing processes
 - Shape (length, width, etc)
 - Weight
 - etc
- Promote item uniformity
- Usually easier to determine compliance
- Logistics support “built-in” to the design

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DESIGN REQUIREMENTS

- Two types
 - Performance-oriented
 - Form, Fit and Function
 - Required interfaces
 - Necessary for any solution
 - Solution-oriented
 - Manufacturing processes
 - Specific as to material, parts, assembly, etc.

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**PERFORMANCE SPECIFICATIONS**

“A performance specification states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. A performance specification defines the functional requirements for the item, the environment in which it must operate, and interface and interchangeability characteristics.”

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**PERFORMANCE SPECIFICATIONS**

- Requirements expressed primarily in terms of performance
- Detail design requirements limited to those necessary for:
 - Form, fit and function
 - Interchangeability
 - Interoperability
 - Human factors
 - Operational environment

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REQUIREMENTS IN PERFORMANCE SPECIFICATIONS

- Materials - Allow flexibility of choice by stating compatibility, corrosion resistance, strength, elasticity, etc., requirements
- Physical characteristics - Limited to interface, interoperability, operating environment or human factors
- Design and construction - Limited to desired outcomes and functions and any required interfaces (based on support strategy)

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PERFORMANCE SPECIFICATIONS

- Performance specifications must pass an “acid test” for purity
- Inclusion of detail design requirements beyond those **necessary** for form, fit, function, operating environment or human factors make the document a detail specification
 - Inclusion of any solution-specific requirements will cause a specification to be a Detail Specification

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PERFORMANCE REQUIREMENTS

- Characteristics describing what the item or system will do - not how performance is achieved
 - Capacity
 - Speed
 - Strength
 - Etc

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PERFORMANCE REQUIREMENT

“The windshield must withstand the impact of a freshly killed four pound chicken at a speed of 220 mph.”

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