

FUNDAMENTALS OF CONFIGURATION MANAGEMENT

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FUNDAMENTALS OF CONFIGURATION MANAGEMENT

● TO MY WIFE MARY SAMARAS AND TO
BILLY AND DANNY JONES

● TO MY WIFE AND FAMILY
ANN, LYNNE, AND MICHAEL CZERWINSKI

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T.T.S.
F.L.C.

PREFACE

During the last 15 years aerospace programs have emphasized areas of the engineering profession previously unknown to many engineers and managers. Configuration management is one of these areas that have become increasingly important to programs involving the design, development, production, testing, and deployment of aerospace instruments and systems. To many engineers and managers configuration management is an esoteric term, but one that they are encountering more frequently in their daily routines because of the government's growing demands for stricter control over the equipment it buys. Configuration management is the discipline of ensuring that equipment or hardware meets carefully defined functional, mechanical, and electrical requirements and that any changes in these requirements are rigidly controlled, carefully identified, and accurately recorded.

Because of the importance and wide application of configuration management in space and atmosphere instrumentation work, most aerospace engineers become involved in it to some degree and therefore must be familiar with its techniques and principles to perform their jobs effectively. Indeed, many government contracts explicitly require that configuration management be employed on projects they cover. Thus technical people who work in equipment design, manufacturing, quality assurance, testing, documentation, or management must have a basic knowledge of configuration management objectives and procedures.

The purpose of this book is to describe the fundamentals of configuration management so that engineering students, designers, engineers, project managers, and administrative personnel can have a common language for working effectively with their configuration management counterparts—for it is certain that during their careers in the aerospace industry they will require an understanding of the configuration manager's role and activities on their projects.

Configuration managers will find the information presented useful as a reference for basic configuration principles and as a guide for their assistants and fledgling configuration managers. This book will also provide engineers interested in good management with a broad view of engineering control activities related to the successful completion of a project.

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Chapter 1

INTRODUCTION

Although “configuration management” is an esoteric term, its concepts and practices are universally applied by industry to deliver a product that meets customer requirements. Of course, the degree and consistency of application vary widely, depending on the complexity and use of the product and the management philosophy of the company. For sophisticated products built to stringent standards such as those imposed by the government for aerospace and military systems, the formalized discipline of providing uniform product descriptions, status records and reports, and change control is called configuration management. The formal implementation of this discipline is a major task involving numerous specialized concepts, personnel, and procedures. This book describes the fundamentals, techniques, and latest developments of configuration management so that its basic principles can be rationally and effectively applied.

Chapter 1 is devoted to general configuration management topics, such as basic concepts, definitions, objectives, and techniques, as well as its history and its future. The following chapters describe the detailed aspects of configuration control, identification, and accounting. Because of the specialized terminology, a list of acronyms and a detailed glossary are included for reference.

The term “product” is used in this text to represent a system,¹ subsystem, equipment, instrument, component (power supply, regulator, etc.), data software, or operational computer software. The official term applied to the total product or selected portions of the product is configuration item (CI).² Although “contract end item” (CEI) is the more traditional term, all elements (end items) of a product are not necessarily line items of a contract; therefore, CI is the preferred term and will be used throughout

¹ A system is a grouping of subsystems, equipments, and components. The term may also include personnel and facilities.

² The selection of CI levels comprising a parent product is discussed in Chapter 7.

2 Introduction

the following chapters. In either case, CI and CEI identify a product, or product element, as being subject to configuration management procedures and requirements.

1.1 BASIC CONCEPTS

With thousands of engineering changes a normal part of the development of a complex product, how can the customer and builder be sure that the product initially described in a specification and contract is what is delivered? Stripped to essentials, configuration management directs itself at this need to know just what the product, operational computer software,³ and supporting data (drawings, operating manuals, repair instructions, etc.) consist of as the project evolves with changes that occur daily.

“Configuration management implicitly accepts these changes during the progress of a project as something normal—not something to be deplored, but something to be managed. This means that, by the process of configuration management, we progressively define the shape and form of the project or item we are managing. We must accept, as a necessary condition for technological growth and cost effectiveness,⁴ the idea that change when properly managed is a vehicle for optimizing costs and other interface⁵ and project control considerations, but in the absence of control of change we have, in effect, technological anarchy.”⁶

Configuration management is really the formalization of a discipline which every effective manager adapts informally in one way or another. It integrates the technical and administrative actions of identifying, documenting, controlling, and reporting the functional and physical characteristics of a product during its life cycle; it also controls changes proposed to these characteristics. Thus configuration management is the means through which the integrity and continuity of technical and cost decisions related to product performance, producibility,⁷ operation, and maintenance are recorded, communicated, and controlled by project managers.

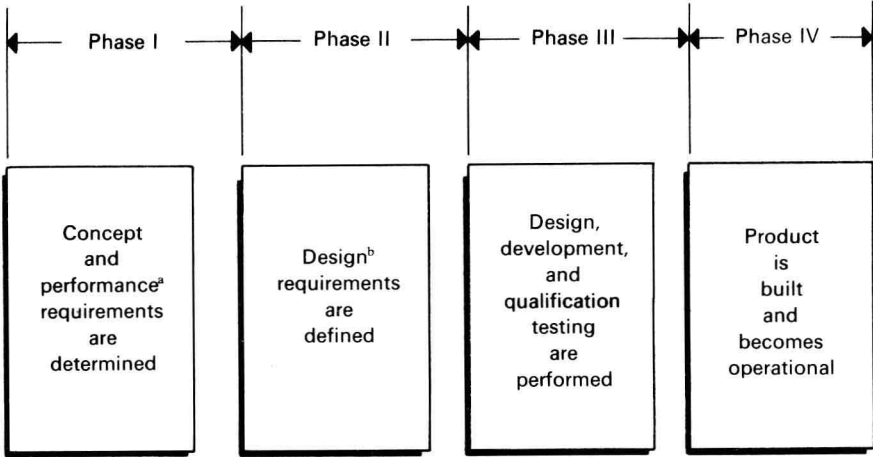
³ Computer instructions functioning as operational entities or in conjunction with associated hardware in achieving system requirements.

⁴ Cost effectiveness is the ability of an item to fulfill a specific need at minimum cost during its life cycle.

⁵ Interfaces are common boundaries between two or more products, companies, or government agencies where physical and functional compatibility are required.

⁶ Presentation by Mr. George E. Fouch, Deputy Assistant Secretary of Defense (Installation and Logistics) Management Systems and Programs, before the Third Annual Configuration Management Workshop of the Electronics Industries Association, San Diego, California, November 19, 1968.

⁷ Ease of manufacture and assembly of an item, including access to its parts, tooling requirements, and realistic tolerances.



^a The meaning of “performance” depends on the product type; e.g., the performance of an aircraft would be defined as its maximum range, maximum and cruising speed requirements, airlift capacity, etc.

^b Design requirements define the product’s mechanical and electrical characteristics; e.g., its weight, size, power consumption, center of gravity, operating temperature, etc.

Figure 1.1 Life cycle of a product.

The term “progressive definitization” is a key concept in configuration management that should be stressed in the following respect: as a product proceeds through research, conceptual design, development, detail design, qualification, first article (product) production, and follow-on production, the identification of its configuration becomes progressively more definite and precise, and may be continually modified throughout the service life of the product. Accordingly, the configuration of a product is *derived* during development, *determined* during design, *established* during production, and *maintained* during operational support. Operational support refers to the requirements for operation, maintenance, and repair of a product during actual use.

Figure 1.1 illustrates the phases of a product’s life. Regardless of the titles you choose to put on these phases, they always exist within good engineering and business practice in industry.

Any product, be it an aircraft or a pencil, must have some reason for being, a function that has to be performed—a performance requirement. While this requirement and the general form of the product are being established we are in the initial phase: *concept and performance requirements*