IEEE Std 1220™-2005
(Revision of
IEEE Std 1220-1998)

IEEE Standard for Application and Management of the Systems Engineering Process

Sponsor

Software and Systems Engineering Standards Committee
of the
IEEE Computer Society

Approved 20 March 2005

IEEE-SA Standards Board

Abstract: The interdisciplinary tasks, which are required throughout a system's life cycle to transform customer needs, requirements, and constraints into a system solution, are defined. In addition, the requirements for the systems engineering process and its application throughout the product life cycle are specified. The focus of this standard is on engineering activities necessary to guide product development while ensuring that the product is properly designed to make it affordable to produce, own, operate, maintain, and eventually to dispose of, without undue risk to health or the environment.
Keywords: acquire, analysis, architecture, building block, design, development, component, hardware, interface, life cycle processes, software, supplier, synthesis, system, system life cycle, systems engineering, technical management, validation, verification

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3 Park Avenue, New York, NY 10016-5997, USA

Print: ISBN 0-7381-4691-9 SH95334
PDF: ISBN 0-7381-4692-7 SS95334

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Introduction

This introduction is not part of IEEE Std 1220-2005, IEEE Standard for Application and Management of the Systems Engineering Process.

History

IEEE Std 1220 was initially published in January 1995 as a trial-use standard. After the two-year trial-use period, the document was revised and balloted in 1998 for full publication in 1999.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) formed a joint body to collaborate in fields of mutual interest for worldwide standardization efforts. ISO/IEC established a joint technical committee for international standards development, ISO/IEC JTC 1, Information Technology. In parallel with IEEE Std 1220 developments, ISO/IEC JTC 1, Subcommittee 7 (SC7), Software and Systems Engineering, began generation of ISO/IEC 15288:2002 [B3].[a] ISO/IEC 15288:2002 provides a framework based on a broad set of processes that an organization or project may employ to perform or manage the stages of a system's life cycle. ISO/IEC 15288:2002 supports the full life cycle of systems—from conception through retirement—as well as the acquisition and supply of systems.

It is the intent of ISO/IEC 15288:2002 to establish standard life cycle process descriptions suitable for most man-made systems. As such, the processes and terminology of the standard are defined at an appropriately high level of abstraction. ISO/IEC 15288:2002 does not prescribe, nor provide, detailed system engineering process definitions or methods and procedures to address detail process requirements derived from the application of this standard. ISO/IEC TR 19760:2003 [B4], the companion guide for ISO/IEC 15288:2002, lists several standards, including IEEE Std 1220-1998, that cover engineering disciplines at a lower-tier level and are suitable for implementation with ISO/IEC 15288:2002.

This revision of IEEE Std 1220-1998 is a result of an ongoing harmonization of the standards of the IEEE Computer Society's Software and Systems Engineering Standards Committee (S2ESC) and the corresponding international standards committee, ISO/IEC JTC1/SC7. This initial alignment of IEEE Std 1220-1998 with ISO/IEC 15288:2002 was developed in cooperation with ISO/IEC JTC1/SC7 and included participation of the International Council on Systems Engineering (INCOSE). The next step towards harmonization of these two standards would be the submission of IEEE Std 1220-2005 for a "fast-track" ballot with ISO/IEC JTC1/SC7 followed by a coordinated revision.

The IEEE Computer Society has embraced the top-level framework provided by ISO/IEC 15288:2002 and has adopted ISO/IEC 15288 as IEEE Std 15288™-2004. The IEEE Computer Society offered to align IEEE Std 1220-1998 with ISO/IEC 15288:2002 to facilitate the joint use of the two standards to manage system engineering efforts. The purpose of this revision of IEEE Std 1220-1998 is to identify key similarities and differences in the two standards and demonstrate how they can be used together while minimizing the impact of ISO/IEC 15288:2002 on current IEEE Std 1220-1998 users who may not employ ISO/IEC 15288:2002.

The key differences between this version of the standard, IEEE Std 1220-2005, and the 1998 version are as follows:

a) Inclusion of explanations regarding key differences between IEEE Std 1220-1998 and ISO/IEC 15288:2002 in areas such as terminology and structure

b) Minimal adjustments to some IEEE Std 1220-1998 terms and definitions for alignment with ISO/IEC publication requirements

c) Clarification of the distinction between requirements and recommendations of the standard

[a]The numbers in brackets correspond to those of the bibliography in Annex D.

d) Update of the conformance clause for alignment with IEEE standards style and rules

Most of the IEEE Std 1220-1998 content remains the same in this version. Explanations to facilitate use of IEEE Std 1220 with ISO/IEC 15288:2002 are contained in a new Annex C.

Purpose

This standard defines the requirements for an enterprise's total technical effort related to development of products (including computers and software) and processes that will provide life cycle support (sustain and evolve) for the products. It prescribes an integrated technical approach to engineering a system and requires the application and management of the systems engineering process throughout a product life cycle. The systems engineering process is applied recursively to the development or incremental improvement of a product to satisfy market requirements and to simultaneously provide related life cycle processes for product development, manufacturing, test, distribution, operation, support, training, and disposal.

The concept of systems engineering embodied in this standard provides an approach for product development in a system context. It is not meant to describe what an organizational entity called systems engineering does or a job position for which a systems engineer is responsible. Rather, it encompasses what all organizational entities and all enterprise and project personnel must accomplish to produce a quality, competitive product that will be marketable, will provide an acceptable return on investment to the enterprise, will achieve stakeholder satisfaction, and will meet public expectations.

The fundamental systems engineering objective is to provide high-quality products and services, with the correct people and performance features, at an affordable price, and on time. This involves developing, producing, testing, and supporting an integrated set of products (hardware, software, people, data, facilities, and material) and processes (services and techniques) that is acceptable to stakeholders, satisfies enterprise and external constraints, and considers and defines the processes for developing, producing, testing, handling, operating, and supporting the products and life cycle processes. This objective is achieved by simultaneous treatment of product and process content to focus project resources and design decisions for the establishment of an effective system design. This involves an integrated handling of all elements of a system, including those related to manufacturing, test, distribution, operations, support, training, and disposal.

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Participants

At the time this standard was completed, the IEEE 1220 Revision Working Group had the following membership:

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The following organizational representative voted on this standard:

Lorraine Pajerek, INCOSE

In addition, this standard was coordinated with the following organizations:

GEIA
NDIA

When the IEEE-SA Standards Board approved this standard on 20 March 2005, it had the following membership:

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Contents

IEEE Standard for Application and Management of the Systems Engineering Process

1. Overview

1.1 Scope

This standard defines the interdisciplinary tasks that are required throughout a system's life cycle to transform stakeholder needs, requirements, and constraints into a system solution. This standard is intended to guide the development of systems for commercial, government, military, and space applications. The information applies to a project within an enterprise that is responsible for developing a product design and establishing the life cycle infrastructure needed to provide for life cycle sustainment.

This standard specifies the requirements for the systems engineering process (SEP) and its application throughout the product life cycle. It does not attempt to define the implementation of each system life cycle process, but addresses the issues associated with defining and establishing supportive life cycle processes early and continuously throughout product development. In addition, the standard does not address the many cultural or quality variables that should be considered for successful product development. The standard focuses on the engineering activities necessary to guide product development while ensuring that the product is properly designed to make it affordable to produce, own, operate, maintain, and eventually to dispose of, without undue risk to health or the environment.

The requirements of this standard are applicable to new products as well as incremental enhancements to existing products. It applies to one-of-a-kind products, such as a satellite, as well as products that are mass-produced for the consumer marketplace. The requirements of this standard should be selectively applied for each specific system-development project. The role of systems engineering within the enterprise environment is described in Annex A.

The content of this standard describes an integrated approach to product development, which represents the total technical effort for the following:

a) Understanding the environments and the related conditions in which the product may be utilized and for which the product should be designed to accommodate

b) Defining product requirements in terms of functional and performance requirements, quality factors, usability, producibility, supportability, safety, and environmental impacts

c) Defining the life cycle processes for manufacturing, test, distribution, support, training, and disposal, which are necessary to provide life cycle support for products