INTERNATIONAL STANDARD

ISO 14621-1

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Space systems — Electrical, electronic and electromechanical (EEE) parts —

Part 1:
Parts management

Systèmes spatiaux — Composants électriques, électroniques et électromécaniques (EEE) —

Partie 1: Gestion des composants

Reference number
ISO 14621-1:2003(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 14621-1 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 14621 consists of the following parts, under the general title *Space systems — Electrical, electronic and electromechanical (EEE) parts*:

— *Part 1: Parts management*

— *Part 2: Control programme requirements*

Introduction

This part of ISO 14621 is a document designed to assist the user community in developing a parts programs by providing a descriptive process for the design, selection and application of space parts. The strategy represented in this document is a system approach to managing risk at the start of the program by selecting the right part for the application. Utilizing this part of ISO 14621 to its fullest potential means understanding the new business environment which embodies some newly accepted business challenges.

This part of ISO 14621 discusses the following 10 key elements that support this new business environment:

— Part obsolescence management — minimize program disruption and ensure long-term supportability throughout the program life cycle.

— Supplier management — establish teaming partnerships with key suppliers to improve delivery and lower cost.

— Standard supplier assessments — eliminate redundant efforts and non-value added evaluations.

— Cost management — realize significant cost reduction on existing and new programs.

— Technology insertion — focus on utilizing technologies with lowest life cycle cost and maximum longevity.

— Communication information exchange — share contractor data via innovative concepts.

— Process control — validate supplier techniques for monitoring critical manufacturing processes.

— Oversight — transition customer oversight to integrated product team (IPT) insight and participation by the customer.

— Concurrent engineering — encourage parts engineering participation in all phases of the product life cycle.

— Training — establish program awareness of reformed acquisition strategy throughout all levels of the user community.

Those specific elements or opportunities are presented in descriptive terms and illustrated in graphic flow charts. There is no intent to provide detailed descriptions of “how to” in this document. It may be cited as a basic guideline within a statement of work and/or for assessing proposals and contractor performance. All levels of contractual relationships (acquiring activities, primes, subcontractors and suppliers) may use this part of ISO 14621. It is the responsibility of the user community to establish, define and administer those tasks based on the program goals and objectives and thus provides the “what” elements envisioned and allows users the opportunity to establish their appropriate criteria for their program.

Although this part of ISO 14621 was written with the intent of covering EEE parts, the concept established is a system approach for developing a EEE parts program with reference to specific material and mechanical processes that make up EEE parts.

Space systems — Electrical, electronic and electromechanical (EEE) parts —

Part 1: Parts management

1 Scope

This part of ISO 14621 addresses the preferred programme elements recommended for EEE parts. This part of ISO 14621 is written in general terms as a baseline for developing and implementing a parts programme.

2 Terms definitions, abbreviated terms and acronyms

2.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1.1
best practice
documented process or product developed by the user community, consisting of suppliers and customers, teaming for the purpose of establishing industry guidelines

2.1.2
integrated product team
IPT
integrated product team consisting of members selected from the appropriate disciplines

EXAMPLE Engineering, manufacturing, quality, suppliers or customers, as appropriate.

2.1.3
IPT product
product conceived through “best practice” design process with respect to the bill of materials and documentation for the hardware as described by the product specification

2.1.4
manufacturer
company or organization that transfers raw material into a product

2.1.5
part
device that performs an electronic, electrical, or electromechanical (EEE) function and consists of one or more elements so joined together that they cannot normally be disassembled without destroying the functionality of the device

2.1.6
performance specification
document that defines what the customer desires as a product, its operational environments and all required performance characteristics

2.1.7
product specification
document that defines the end item(s) the supplier intends to provide to satisfy all the performance specification requirements

2.1.8
reliability engineering
integral part of the system engineering requirements definition and analysis function

NOTE The tasks are to conduct cost/benefit trade-offs and to analyse and determine alternative design and procurement solutions.

2.1.9
sunset
products/parts that have reached shelf-life expectancy

2.1.10
systems engineering
an interdisciplinary, collaborative approach to derive, evolve and verify a life-cycle balanced system solution which satisfies customer expectations and meets public acceptability

2.1.11
technology insertion strategy
decision making process to assess current and future part availability and trends, which leads to a decision regarding emerging or new technology insertion

NOTE This process is used in the concept development phase, but also impacts the production and field support phases.

2.1.12
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

[ISO 9000:2000]

2.1.13
vendor
seller of parts, products, or commodities; may be interchangeable with manufacturer, depending on the application

2.1.14
verification
confirmation, through the provision of objective evidence that specified requirements have been fulfilled

[ISO 9000:2000]

2.2 Abbreviated terms and acronyms

ARN	anticipated reliability number
ASIC	application specific integrated circuit
BOM	bill of materials
CAM	computer-aided manufacturing
Cpk	process capability
DEMP	discharge electromagnetic pulse

DIC	digital integrated circuit
DM	design margin
DMSMS	diminishing manufacturing sources and material shortages
DoE	design of experiments
DPA	destructive physical analysis
EEE	electronic, electrical and electromechanical
EMC	electro-magnetic compatibility
EMP	electromagnetic pulse
EPI	epitaxial
ESD	electrostatic discharge
FMECA	failure modes and effects criticality analysis
F^3I	form, fit, function interfaces
HAST	highly accelerated stress test
HEMP	high altitude electromagnetic pulse
IPD	integrated product design
IPT	integrated product team
MPU	microprocessing unit
NDI	nondevolopmental item
OEM	original equipment manufacturer
PEM	plastic encapsulated microcircuit
PWB	printed wiring board
QML	qualified manufacturers list
QPL	qualified parts list
RH	relative humidity
SEB	single event burnout
SEE	single event effects
SEGR	single event gate rupture
SEL	single event latchup
SEU	single event upset
SGEMP	system-generated electromagnetic pulse
SPC	statistical process control
WWW	world wide web

3 Parts management

3.1 Parts management process

3.1.1 General

The process employed within this part of ISO 14621 was developed to assist in dealing more proactively with critical parts management issues and to provide guidance for developing comprehensive strategies to manage cost and schedule risk via an integrated product team (IPT) process (Figure 1). The main aspects of the parts management process are design process, supplier management and shared data. The design process includes, but is not limited to, design margins, life cycle cost, technology insertion, technical support, system engineering support, parts selection, obsolescence management and validation/verification. The emphasis should be on concurrent rather than sequential consideration of these factors in design. Supplier management proactively selects and monitors the supplier base, while information generated from the design and supplier management processes are organized in a database to be shared with IPT members in reducing cost and improving schedule performance.

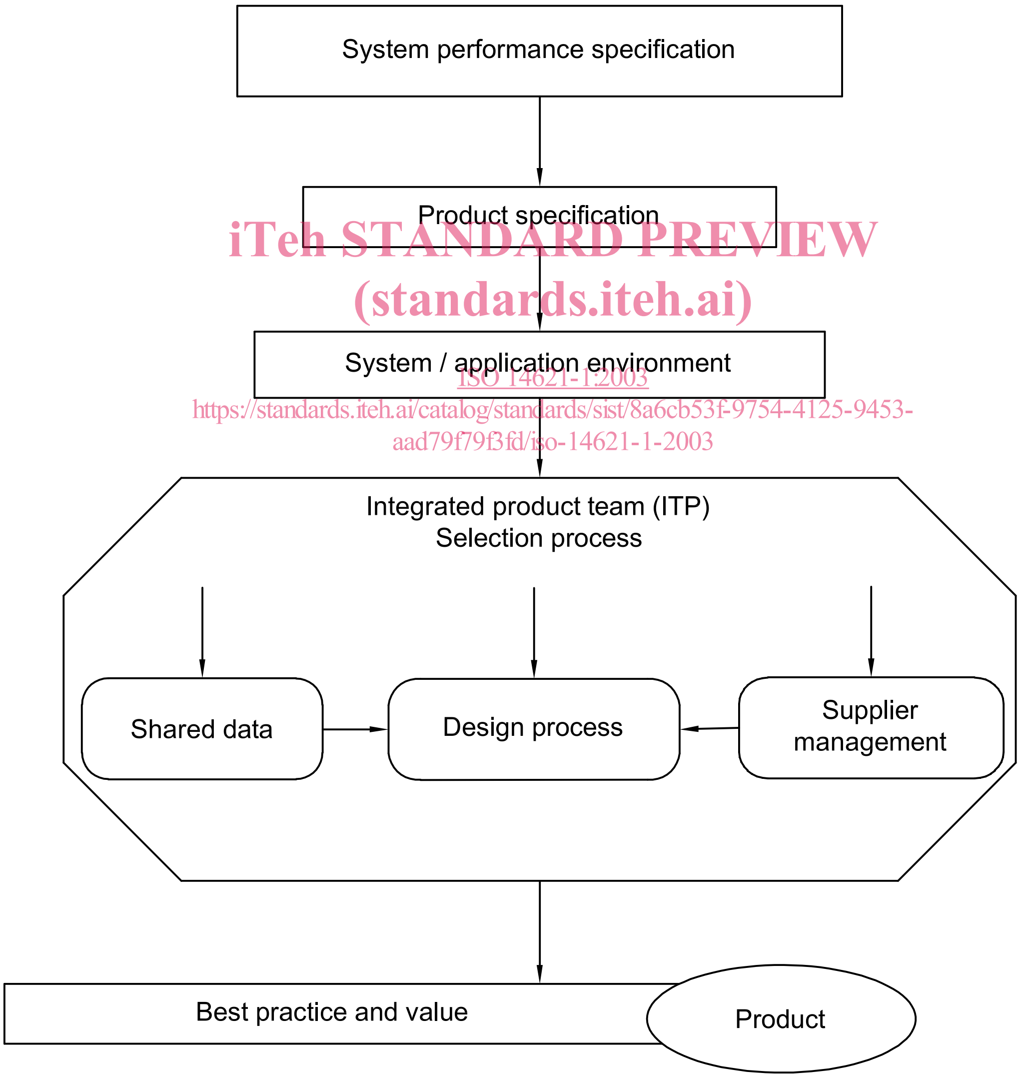

Figure 1 — Parts management IPT overview

3.1.2 Design process

The flow diagram (Figure 2) illustrates the interrelationships of the critical key elements that shall be addressed concurrently by engineering and supplier management (B) (see 3.2), to achieve the “best practice” selection of EEE parts and documentation required for the initial design. The results obtained from this analysis should be made available as shared data (A). See 3.3. The following paragraphs describe the principles embodying the ten key elements. Refer to the introduction.

3.1.3 Design margin

The objective of developing a design margin is to assist integrated product teams with critical analyses resulting in a robust design and minimized life cycle cost. The availability of computer-based analysis and simulation tools presents the opportunity to validate in detail those aspects of design prior to manufacturing/qualification commitment. Creating a design margin analysis based on actual conditions will provide a comprehensive description of EEE part characteristics with simulation results, thereby enhancing system performance. The design margin process (Figure 3) describes a minimum set of design analyses needed to maximize design robustness and identifies control limits and corrective action procedures. Metrics to validate the process include, but are not limited to, the following:

a) comparisons of actual design margins to established baselines;

b) quality of engineering design changes;

c) qualification test performance (failures);

d) prediction analysis yield;

e) manufacturing/production yields.

Associated elements are parts selection (3.1.8) and technical support (3.1.6).

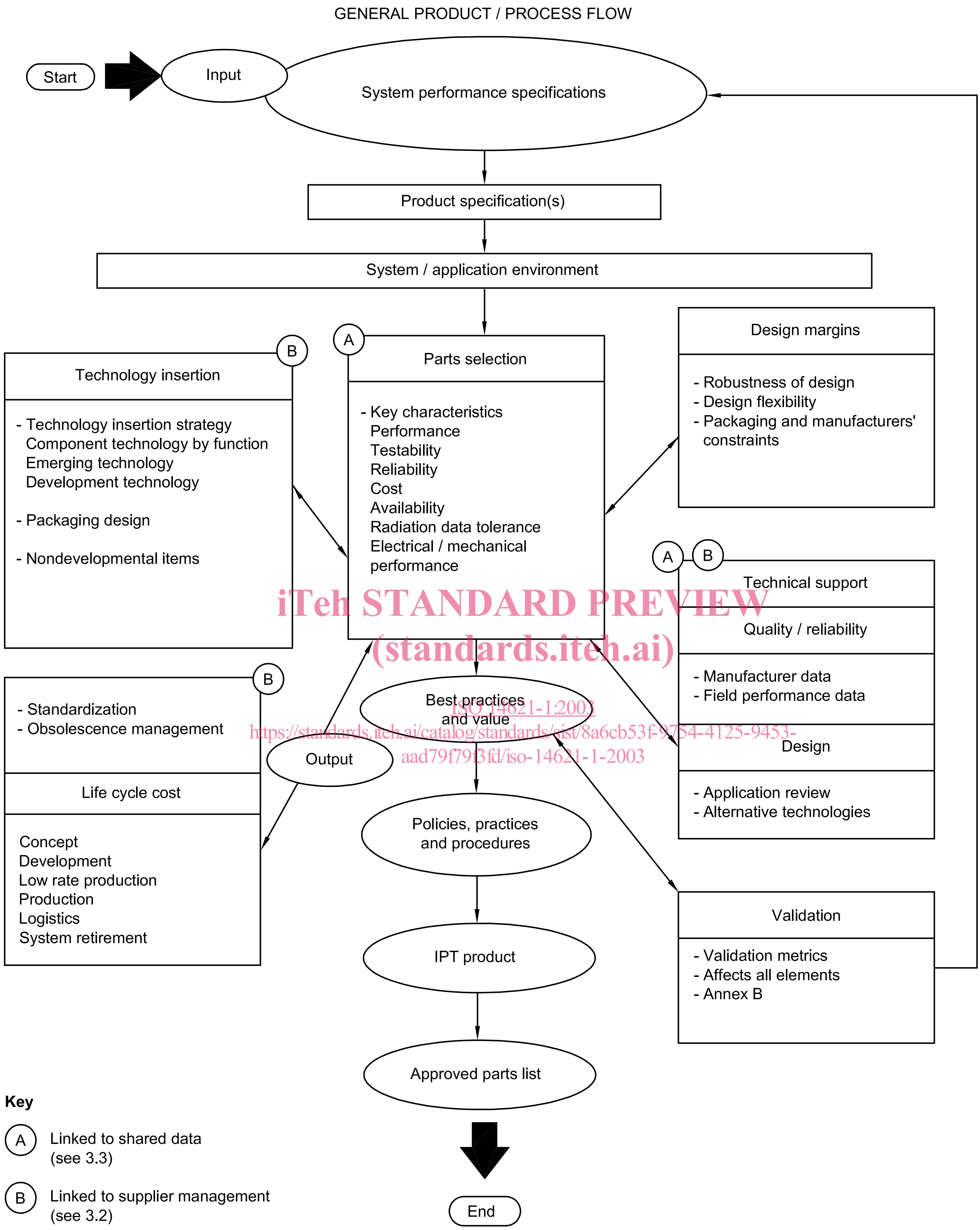

Figure 2 — Concurrent engineering IPT product

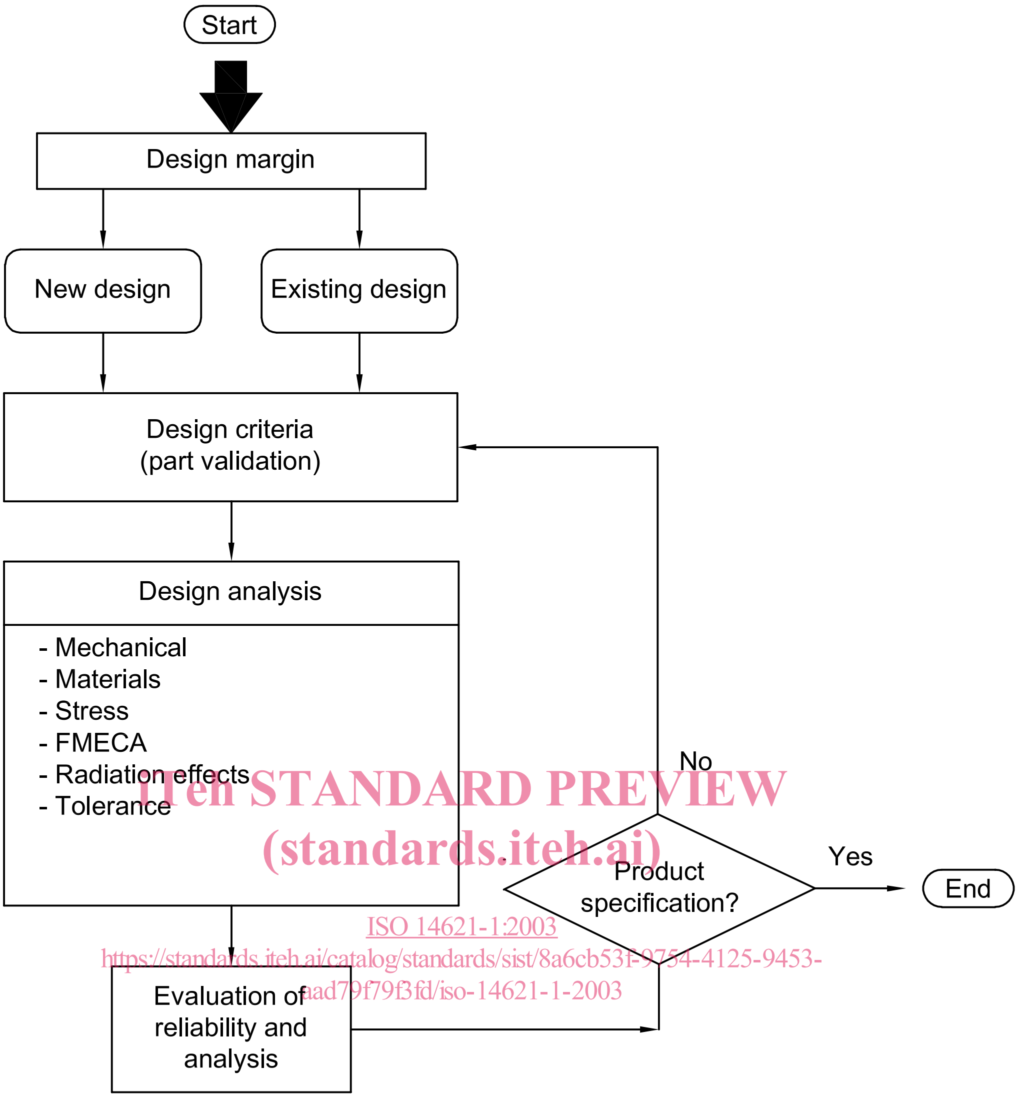

Figure 3 — Design margin process

3.1.4 Life cycle cost

In establishing life cycle cost for EEE parts, the following methods should be employed: identify technology assessment techniques and the risk of part mitigation and utilize procedures that minimize programme disruption (parts obsolescence). This process (analysis) should include as well as define the parts programme baseline and support a methodology to lower cost as well as reduce schedule disruption (programme risk) for the life of the programme (Figure 4).

Standardization techniques are becoming increasingly dependent on the available supplier base and market trends. A new and innovative process being implemented moves away from part number standardization to commodity/technology/family standardization. This concept should provide a lower cost/higher benefit approach as the demand for commercial EEE parts increases.

Factors to be considered include technology maturity, market base, material cost, ease of manufacture, performance management, logistics costs, standardization and form, fit, function interfaces (F^3I). Initial nonrecurring costs should be de-emphasized and rationalized with long-term cost savings to provide the best value to the customer.

Through the implementation of technology assessments, strategic supplier relationships, technology leapfrogging, and creative risk mitigation techniques, program continuity and integrity can be maintained, and life cycle costs can be minimized.

Validation of the life cycle cost objectives can be accomplished through the use of the following methods:

a) design-to-cost trade studies documenting parts selected during the design phase including all elements of cost;

b) periodic programme assessment of life cycle ratings, part technology and part obsolescence;

c) periodic price trend analyses for “road map” technologies to validate that costs are declining as the technologies move from introduction and growth to production maturity in the market;

d) associated elements are

    1) technology insertion strategy (3.1.5),

    2) parts selection (3.1.8),

    3) obsolescence management (3.1.9).

3.1.5 Technology insertion strategy

The objective of the technology insertion strategy is to create a technology road map, which minimizes risk of obsolescence and develops a strategy for technology insertion during the entire life cycle (Figure 5). The commercial industry is driving new technology development of EEE parts. The market dynamics of the industry (availability, functionality, performance, characteristics and packaging) affect the way parts are used in the design. Technology road maps subdivide technologies into functions, which provide the required visibility to resolve future obsolescence and standardization issues. Use of technology road maps is the key element of the parts selection process. Technology road maps shall be assessed over the life of their program to validate their effectiveness.

Associated elements are

a) design margin (3.1.3),

b) life cycle costs (3.1.4),

c) parts selection (3.1.8),

d) obsolescence management (3.1.9).

3.1.6 Technical support

Technical support is an all-encompassing activity established to provide a method of obtaining data to facilitate reliability analysis, monitor applications, identify risk issues and suggest mitigation paths associated with the selected parts (Figure 6). Technical support requires a total commitment by all disciplines and levels of management to ensure success. Specifically, the user shall define his/her reliability requirements. The responsibility for reliability engineering activities shall be established early in the programme in order to minimize cost of unscheduled redesign, rework, or remanufacture, as well as potential safety problems. Accomplishment of the performance objectives will be enhanced through the application of user and field reliability information from shared data. The shared data and supplier management information should be used in support of the IPT for evaluating sourcing, performance, packaging and availability. Associated elements of reliability models are

a) design margin (3.1.3),

b) parts selection (3.1.8),

c) shared data (3.3).

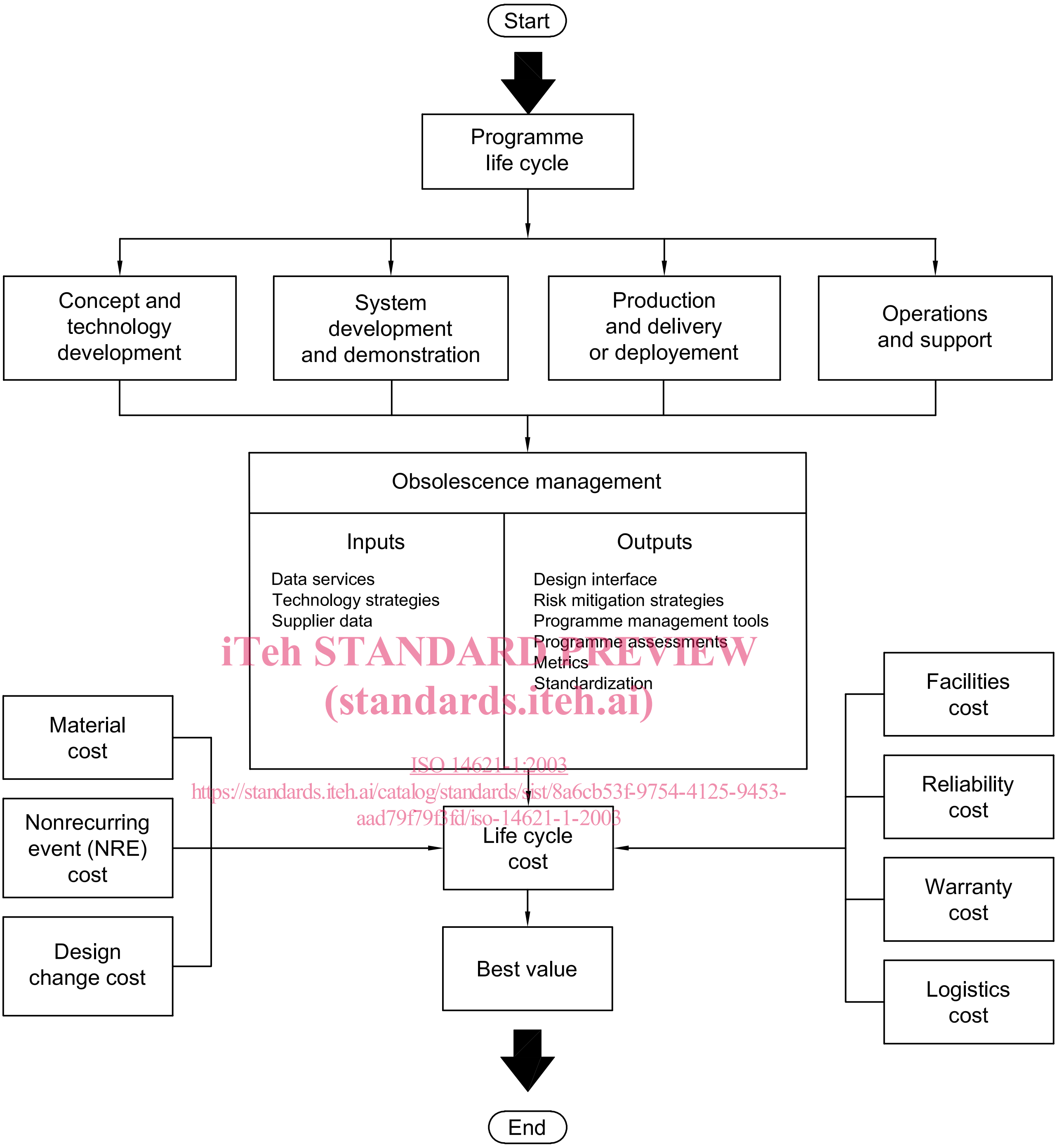

Figure 4 — Life cycle cost process

