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Ergonomic design of control centres —

Part 7: Principles for the evaluation of control centres

Conception ergonomique des centres de commande —
Partie 7: Principes pour l'évaluation des centres de commande

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11064-7 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

ISO 11064 consists of the following parts, under the general title *Ergonomic design of control centres*:

— *Part 1: Principles for the design of control centres*

— *Part 2: Principles for the arrangement of control suites*

— *Part 3: Control room layout*

— *Part 4: Layout and dimensions of workstations*

— *Part 6: Environmental requirements for control centres*

— *Part 7: Principles for the evaluation of control centres*

Introduction

This part of ISO 11064 establishes ergonomic requirements, recommendations and guidelines for the evaluation of control centres.

User requirements are a central theme of this part of ISO 11064 and the processes described are designed to take account of the needs of users at all stages. The overall strategy for dealing with user requirements is presented in ISO 11064-1.

ISO 11064-2 provides guidance on the design and planning of the control centre in relation to its supporting areas. ISO 11064-3 gives all the requirements and guidance on control room layout. Requirements for the design of workstations, displays and controls and the physical working environment are presented in ISO 11064-4 and ISO 11064-6.

The various parts of ISO 11064 cover the general principles of ergonomic design appropriate to a range of industries and service providers.

The users of this part of ISO 11064 are likely to include, for example, project managers, acceptance engineers, purchasers, suppliers and regulatory bodies.

The ultimate beneficiaries of this part of ISO 11064 will be the control centre operator and other users. It is the needs of these users that provide the ergonomic requirements used by the developers of International Standards. Although it is unlikely that the end user will read this part of ISO 11064, or even know of its existence, its application should provide the user with interfaces that are more usable and a working environment which is more consistent with operational demands. It should result in a solution that will minimize error and enhance productivity.

The terms “human factors” and “ergonomics” are used interchangeably in ISO 11064 and are considered as synonyms.

Ergonomic design of control centres —

Part 7:
Principles for the evaluation of control centres

1 Scope

This part of ISO 11064 establishes ergonomic principles for the evaluation of control centres. It gives requirements, recommendations and guidelines on evaluation of the different elements of the control centre, i.e. control suite, control room, workstations, displays and controls, and work environment.

It covers all types of control centres, including those for the process industry, transport systems and dispatching rooms in the emergency services. Although this part of ISO 11064 is primarily intended for non-mobile control centres, many of the principles could be relevant/applicable to mobile centres, such as those found on ships and aircraft.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11064-1:2000, *Ergonomic design of control centres — Part 1: Principles for the design of control centres*

ISO 13407, *Human-centred design processes for interactive systems*

3 Terms and definitions

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

3.1
evaluation process
combined effort of all verification and validation (V&V) activities in a project using selected methods and the recording of the results

NOTE “Evaluation process” is used synonymously with “verification and validation process”.

3.2
human engineering discrepancy
HED
departure from some benchmark of system design suitability for the roles and capabilities of the human operator and/or user

NOTE This may, for example, include a deviation from meeting an operator/user preference.

3.3
resolution
identification and implementation of solutions to the deviations identified during the verification and validation activities

3.4
situation awareness
relationship between the operator's/user's understanding of the controlled system's and/or process's condition and its actual condition at any given time

NOTE Originally defined by Endsley [4] in an aircraft pilot context as “The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future”.

3.5
validity
degree to which an instrument or technique can be demonstrated to measure what it is intended to measure

NOTE 1 Face validity is concerned with how a measure or procedure appears. It answers the question: Does it seem like a reasonable way to gain the information the evaluator(s) are attempting to obtain?

NOTE 2 Predictive validity will tell whether it is possible to predict from the studied performance measure to the real environment.

3.6
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application has been fulfilled

NOTE 1 Adapted from ISO 9000:2005, 3.8.5.

NOTE 2 See Figure 1.

NOTE 3 This term is often used in conjunction with “verification” and both terms abbreviated to “V&V” (verification and validation).

3.7
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

NOTE 1 Adapted from ISO 9000:2005, 3.8.4.

NOTE 2 See Figure 1.

NOTE 3 This term is often used in conjunction with “validation” and both terms abbreviated to “V&V” (verification and validation).

3.8
verification and validation plan
V&V plan
plan specifically developed to govern the evaluation process

3.9
workload
physical and cognitive demands placed on the system user(s) and/or staff

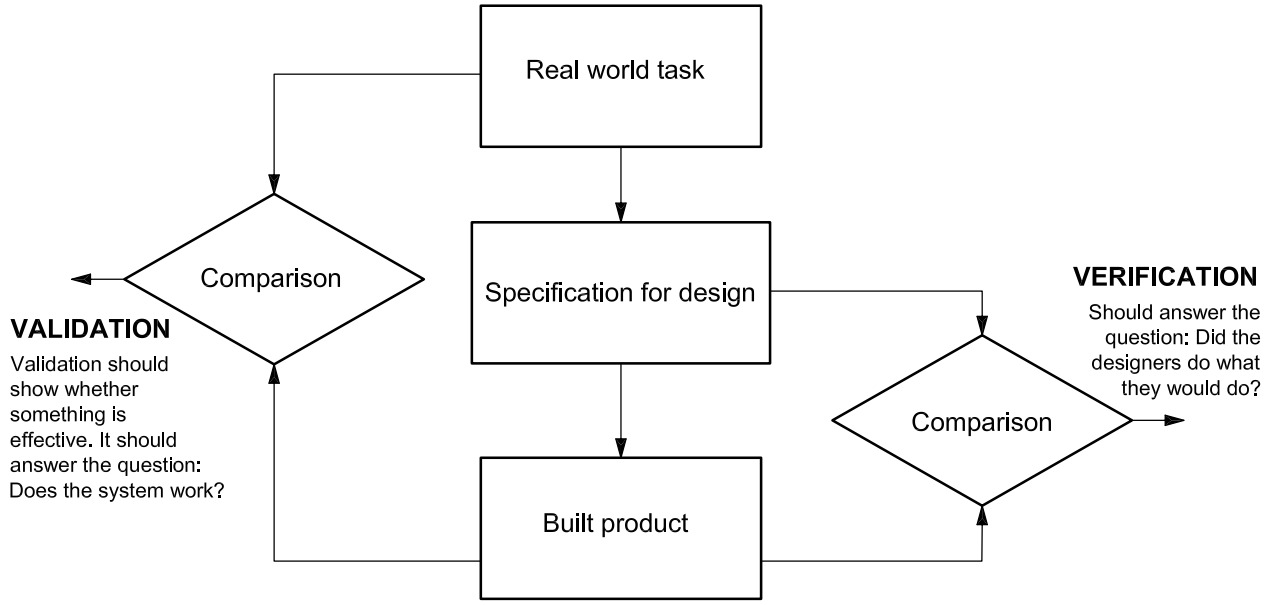

Figure 1 — Role of verification and validation (V&V)

4 Requirements and recommendations for evaluation process

Subclauses 4.1 to 4.10 present general requirements and recommendations for the ergonomic evaluation process. See Annex A for a checklist of these requirements and recommendations.

4.1 General verification and validation (V&V) issues

a) The verification and validation (V&V) activities shall be an integral part of the design process, in accordance with ISO 13407 and ISO 11064-1:2000, Figure 2, and with the Figure 2 immediately below.

b) The V&V activities shall take place throughout the life of a project.

c) Tests shall be done as early in the design process as possible, to allow modifications to be made.

Previous V&V work can be reused under certain conditions. Final determination of what form of V&V is acceptable for evolutionary changes shall be decided in each particular case. For further information, see Annex B.

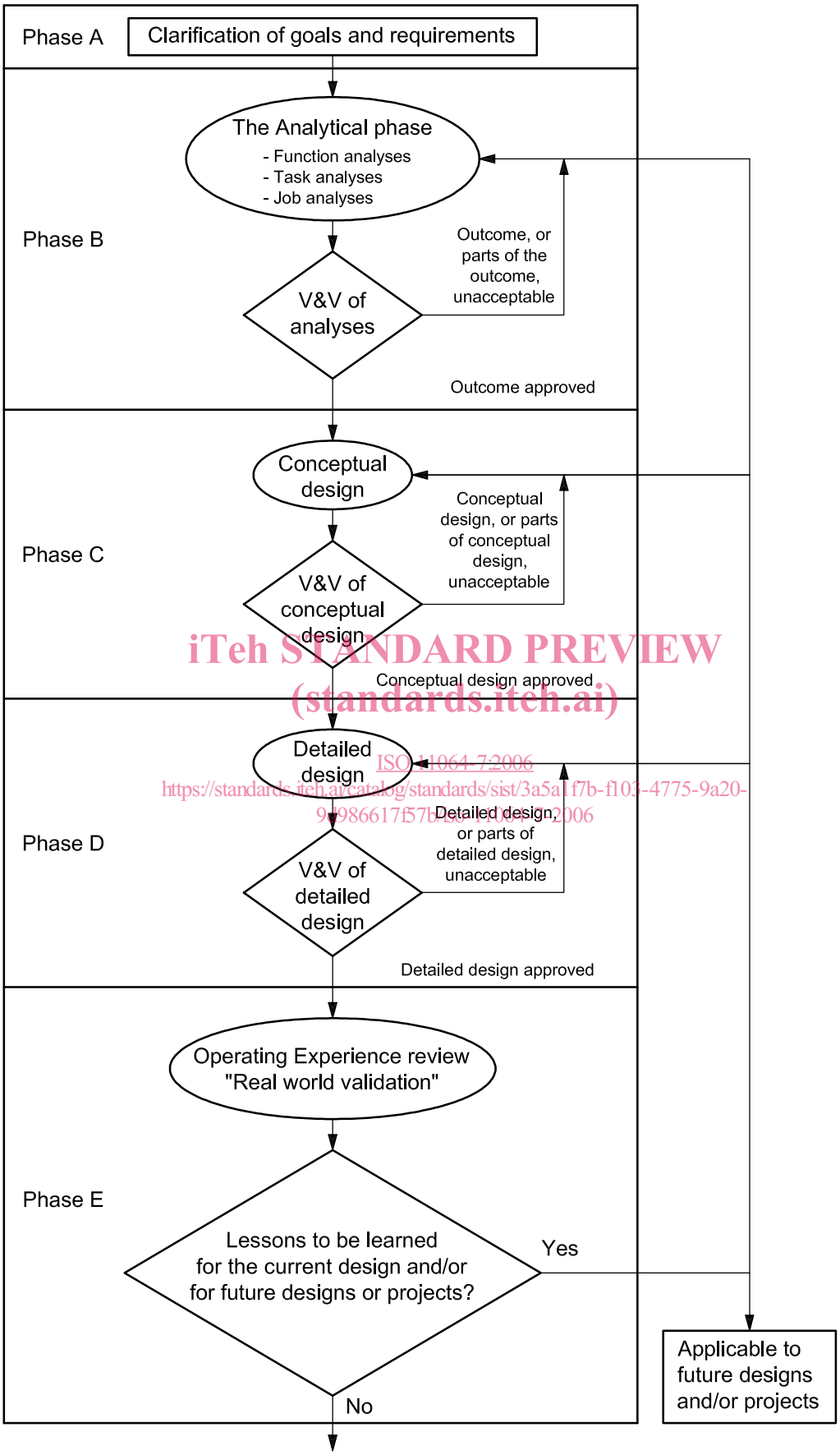

Figure 2 — Integrated V&V in design process

4.2 Verification and validation plan

a) A V&V plan shall be prepared early in the project and before the V&V work is carried out.

NOTE The plan would be expected to contain, as a minimum, details of the following:

— The objectives for V&V, e.g. maximising human performance, safer operations, human error reduction, enhanced operator support tools, increased job satisfaction and improved production.

— The mandate and terms for V&V.

— The relationship and interfaces of V&V to other elements both within and outside the project, e.g. the design process and the quality assurance programme.

— The V&V team, its primary responsibilities, and resources available to it.

— The approach to be taken to the V&V programme.

— How the process will be applied.

b) The plan should detail the time requirements, relations and dependencies between the tasks within the evaluation process and extend throughout the entire project's duration.

c) The plan for evaluation should have an entry for each topic being reviewed.

d) The plan should document all the criteria, the techniques and tools to be utilised in the evaluation process.

e) The plan shall describe the activities to be performed, and for the verification case, describe each phase to show whether the requirement specification is met.

f) For the validation case, the project should develop performance and safety objectives for the topic under review.

g) Estimates of the resources required to undertake V&V tasks shall be prepared and shall include staff, equipment, accommodation and subjects for trials.

4.3 Verification and validation scope

a) The evaluation scope should be appropriate for the stage of the project at which it is performed.

b) The validation process should challenge the design and ascertain that the system will perform acceptably under a broad range of operating conditions. The validation should include consideration of appropriate scenarios, or working sequences, that should cover normal operation — including a mix of multiple failure events and disturbances, and emergency conditions.

c) There should be written description of appropriate operating situations, adapted to the chosen verification/validation method and the stage of the project.

d) The general scope of the V&V should include all essential facilities defined in the project plan.

NOTE The V&V scope might cover, among other items, the following topics:

— hardware having a human-system interface (HSI);

— HSI software;

— communications facilities;

— procedures (written or electronic form);