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Space systems — Closed loop problem solving management

Systèmes spatiaux — Gestion de résolution du problème de boucle fermée

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

Introduction

This International Standard is useful to promote a method to identify the root causes of problems including failures, defects, accidents and other undesirable conditions, and to implement corrective actions and preventive actions.

The intent of this International Standard is to define the best practices dealing with root causes analysis and problem solving, prevent recurrence of the problem, and achieve quality improvement. It provides a standard process flow method to identify the root causes and improve the process and achieve quality improvement. It applies to all space products and organizations, at all levels and phases.

The process described in this International Standard is created by comparing and mixing root cause analysis and problem solving methodologies used by main actors of aerospace industry around the world. The process flow chart can be used to find root causes and to solve the problem thoroughly.

This International Standard provides a method for finding the root causes mainly against failures, defects, and accidents. As for non-conformance, ISO 23461 “Programme Management - Nonconformance control system” is usually applied.

When necessary, the problem solving process method in this International Standard should also be used for processing of major non-conformance in ISO 23461.

Space systems — Closed loop problem solving management

1 Scope

This International Standard provides basic procedures and requirements of closed loop problem solving against product quality problems including failures, defects, accidents, and other undesirable conditions for organizations.

This International Standard is intended to improve the closed loop problem solving management which covers the impact mitigation of the problem, root causes identification and problem containment, and lessons learned.

This International Standard is applicable to problem solving management of all space products, starting from engineering development phase.

2 Normative references

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

ISO 10795, *Space systems — Programme management and quality — Vocabulary*

ISO 16192, *Space systems — Experience gained in space projects (Lessons learned) — Principles and guidelines*

ISO 23461, *Space systems — Programme management — Non-conformance control system*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in ISO 10795 and the following apply.

3.1
root cause
original event, action, and/or condition resulting in an actual or potential undesirable condition, situation, nonconformity or failure

Note 1 to entry: There are often several root causes for one problem.

3.2
root cause analysis
process of identifying all root causes that have or may have resulted in an undesirable condition, situation, nonconformity or failure

3.3
lessons learning
process of distributing the problem information to the whole project and organization as well as other related projects and organizations, warning if similar failure modes or mechanism issues exist and taking preventive actions

4 Basic elements for closed loop problem solving management

4.1 Implemention time

The organization shall implement closed loop problem solving management according to this International Standard when the following problems are detected and the root causes are not obvious.

a) Problems in design which might delay development schedule, create interface design change with other business units, lower performance index, and result in production rework.

b) Problems in design and production which might result in major economic losses.

c) Problems in production which might occur repeatedly and in batch due to technology causes.

d) Problems in EEE components and raw materials which might occur in batch due to technology causes.

e) Problems in test technology which might result in test failure or product damage.

f) Problems which might occur due to technology causes after the parts, subsystem, or system were delivered.

g) Problems which might occur due to technology causes in shooting range or launching site.

h) Problems which might occur due to technology causes after the final product had been delivered for use.

i) Problems which might occur in orbit operation and return of satellite and spacecraft, due to failure or other technology causes which can affect mission completion.

j) Problems which might affect cost, schedule, or performance and could jeopardize intended system use.

4.2 Implemention plan

The organization shall prepare an implementation plan for closed loop problem solving with sufficient resource support and incorporate the plan into the organization's quality management activities.

4.3 Problems summary

The organization shall summarize and classify problems at the following key decision points. Inspection and review should be conducted if necessary

a) before transferring to next development phase,

b) before acceptance of components, subsystem, or system,

c) before exfactory of satellites, launch vehicles, and space crafts,

d) before transferring to shooting range or launching site,

e) before launching,

f) cefore the delivery of satellites and space crafts on orbit, and

g) after the return of satellites and space crafts.

4.4 Review

At the end of closed loop problem solving, the organization shall review whether corrective actions are appropriate and effective.

4.5 Records maintenance

The organization shall maintain all records.

5 Procedures of closed loop problem solving management

The organization should use closed loop management of problems in the development phase and the production phase of contractually specified products. In order to ensure that the problem is solved and will not happen again, the organization shall locate the problem accurately, define root causes by theoretical analysis or experiments, conduct problem recurrence experiments when necessary, take corrective actions against the root causes, and implement lessons learning in the whole organization and project. Figure 1 gives the procedures of closed loop problem solving management.

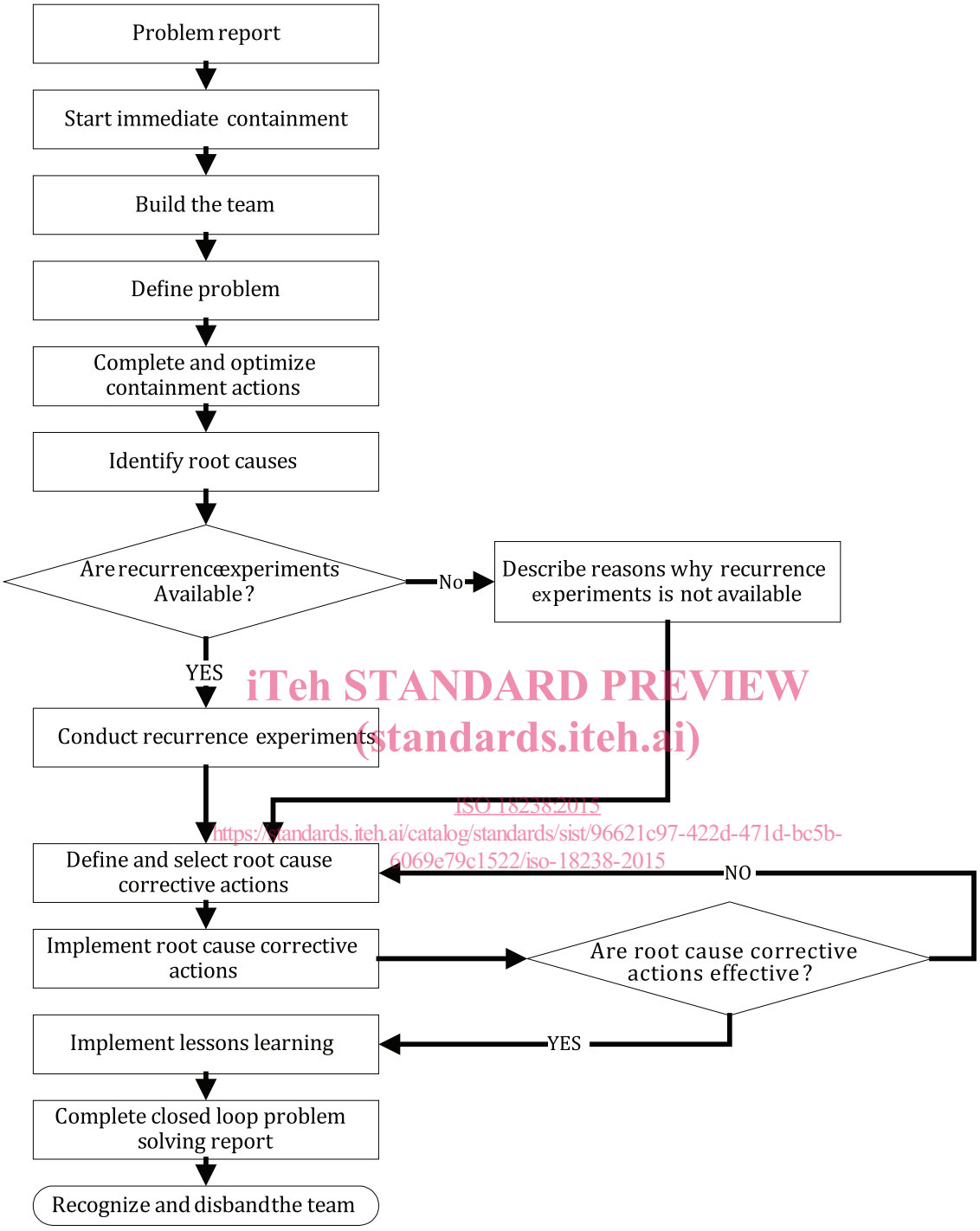

Figure 1 — Procedures of closed loop problem solving management

6 Implementation of closed loop problem solving

6.1 Problem report

a) The objective is to let related people informed about the problem timely.

b) When a problem is detected, the organization shall protect the scene, make records, and report timely without compromising safety and security.

c) Contents of the report include: product information; problem phenomena; test condition; working hours and environment; problem observer, etc.

Non-conformances of deliverable products and supplies shall be reported and disposed in accordance with ISO 23461. The relation between the problem report and the nonconforming report provided in ISO 23461 should be shown when it is done according to this International Standard.

6.2 Start immediate containment actions

a) The objective is to mitigate the impact of the problem, protect the customer operations and the organization, and ensure that problem does not deteriorate before identification of root causes.

b) The organization shall implement immediate containment actions when the problem detected is having an impact now on the customer or the organization, especially if no action is taken, the problem will deteriorate.

c) Immediate containment actions shall be implemented according to the following steps:

1) identify, isolate of defectives and perform immediate correction;

2) identify apparent cause and perform immediate corrective action to eliminate, prevent, or reduce the probability of any additional non-conformances from happening again in the short-term;

3) typical immediate containment actions include

— immediate stop of the working process, including deliveries, recall product if necessary,

— increase inspection, and

— conduct inventory checks and isolation of defectives.;

4) identify immediate potential risk for defectives not detected;

5) determine apparent criticality. Customers or the design department might be asked to assist in evaluating the criticality.

NOTE immediate containment actions terminate when corrective actions are in place or when a more effective containment action is found.

d) The organization shall communicate and implement actions across various entities and other organizations.

1) Identify the entities affected or impacted by the problem(internally and externally).

2) Inform all identified entities.

3) Immediate information to the customer is mandatory if product has been delivered which is known or suspected to be affected by the issue, potentially impacts safety and more generally have a significant impact on customer's operations.

6.3 Build the team

a) The objective is to ensure that representatives from relative parties (suppliers and customers) and functions that might have an influence on the problem solving processes are in the team.

b) Gather a team in which members from different functions have an influence on the problem and get the team prepared to carrying out the problem solving activities. The team should be modified or completed if necessary all along the problem solving process.

c) Sufficient communication is required to ensure

1) team leader has a clear understanding of his responsibility, the team's resources and constraints,