EUROPEAN COOPERATION

ECSS

FOR SPACE STANDARDIZATION

Space project management

Risk management

Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Standard has been prepared by the ECSS-M-ST-80 Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

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Change log

ECSS-M-00-03A 25 April 2000	First issue
ECSS-M-00-03B 16 August 2004	Second issue
ECSS-M-ST-80C 31 July 2008	Third issue Main differences between ECSS-M-00-03B (16 August 2004) and this version are: • Renumbering from ECSS-M-00-03 to ECSS-M-ST-80. • Deletion of the definitions for: .risk, residual risk, risk management, risk management policy because identically defined in ECSS-S-ST-00-01 • Update of descriptive text in clause 4.4, 5.1, 5.2.1.2f, 5.2.1.2h, 5.2.2.1, 6.5c, • In clause 7, former text contained in "AIM" converted into notes and former text from "EXPECTED OUTPUT" deleted or converted into requirements when normative.

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Introduction

Risks are a threat to project success because they have negative effects on the project cost, schedule and technical performance, but appropriate practices of controlling risks can also present new opportunities with positive impact.

The objective of project risk management is to identify, assess, reduce, accept, and control space project risks in a systematic, proactive, comprehensive and cost effective manner, taking into account the project's technical and programmatic constraints. Risk is considered tradable against the conventional known project resources within the management, programmatic (e.g. cost, schedule) and technical (e.g. mass, power, dependability, safety) domains. The overall risk management in a project is an iterative process throughout the project life cycle, with iterations being determined by the project progress through the different project phases, and by changes to a given project baseline influencing project resources.

Risk management is implemented at each level of the customer-supplier network.

Known project practices for dealing with project risks, such as system and engineering analyses, analyses of safety, critical items, dependability, critical path, and cost, are an integral part of project risk management. Ranking of risks according to their criticality for project success, allowing management attention to be directed to the essential issues, is a major objective of risk management.

The project actors agree on the extent of the risk management to be implemented in a given project depending on the project definition and characterization.

1
Scope

This Standard defines the principles and requirements for integrated risk management on a space project; it explains what is needed to implement a project–integrated risk management policy by any project actor, at any level (i.e. customer, first level supplier, or lower level suppliers).

This Standard contains a summary of the general risk management process, which is subdivided into four (4) basic steps and nine (9) tasks.

The risk management process requires information exchange among all project domains, and provides visibility over risks, with a ranking according to their criticality for the project; these risks are monitored and controlled according to the rules defined for the domains to which they belong.

The fields of application of this Standard are all the activities of all the space project phases. A definition of project phasing is given in ECSS-M-ST-10.

This standard may be tailored for the specific characteristics and constraints of a space project in conformance with ECSS-S-ST-00.

2
Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

ECSS-ST-00-01	ECSS system - Glossary of terms
ECSS-M-ST-10	Space project management – Project planning and implementation

3
Terms, definitions and abbreviated terms

3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply, in particular for the following terms:

risk

residual risk

risk management

risk management policy

3.2 Terms specific to the present standard

3.2.1 acceptance of (risk)

decision to cope with consequences, should a risk scenario materialize

> NOTE 1   A risk can be accepted when its magnitude is less than a given threshold, defined in the risk management policy.
>
> NOTE 2   In the context of risk management, acceptance can mean that even though a risk is not eliminated, its existence and magnitude are acknowledged and tolerated.

3.2.2 (risk) communication

all information and data necessary for risk management addressed to a decision–maker and to relevant actors within the project hierarchy

3.2.3 (risk) index

score used to measure the magnitude of the risk; it is a combination of the likelihood of occurrence and the severity of consequence, where scores are used to measure likelihood and severity

3.2.4 individual (risk)

risk identified, assessed, and mitigated as a distinct risk items in a project

3.2.5 (risk) management process

consists of all the project activities related to the identification, assessment, reduction, acceptance, and feedback of risks

3.2.6 overall (risk)

risk resulting from the assessment of the combination of individual risks and their impact on each other, in the context of the whole project

> NOTE   Overall risk can be expressed as a combination of qualitative and quantitative assessment.

3.2.7 (risk) reduction

implementation of measures that leads to reduction of the likelihood or severity of risk

> NOTE   Preventive measures aim at eliminating the cause of a problem situation, and mitigation measures aim at preventing the propagation of the cause to the consequence or reducing the severity of the consequence or the likelihood of the occurrence.

3.2.8 resolved (risk)

risk that has been rendered acceptable

3.2.9 (risk) scenario

sequence or combination of events leading from the initial cause to the unwanted consequence

> NOTE   The cause can be a single event or something activating a dormant problem.

3.2.10 (risk) trend

evolution of risks throughout the life cycle of a project

3.2.11 unresolved (risk)

risk for which risk reduction attempts are not feasible, cannot be verified, or have proved unsuccessful: a risk remaining unacceptable

3.3 Abbreviated terms

For the purpose of this standard, the abbreviated terms of ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
IEC	International Electrotechnical Commission

4
Principles of risk management

4.1   Risk management concept

Risk management is a systematic and iterative process for optimizing resources in accordance with the project's risk management policy. It is integrated through defined roles and responsibilities into the day–to–day activities in all project domains and at all project levels. Risk management assists managers and engineers by including risk aspects in management and engineering practices and judgements throughout the project life cycle, including the preparation of project requirements documents. It is performed in an integrated, holistic way, maximizing the overall benefits in areas such as:

- design, manufacturing, testing, operation, maintenance, and disposal, together with their interfaces;

- control over risk consequences;

- management, cost, and schedule.

4.2   Risk management process

The entire spectrum of risks is assessed. Trade-offs are made among different, and often competing, goals. Undesired events are assessed for their severity and likelihood of occurrence. The assessments of the alternatives for mitigating the risks are iterated, and the resulting measurements of performance and risk trend are used to optimize the tradable resources.

Within the risk management process, available risk information is produced and structured, facilitating risk communication and management decision making. The results of risk assessment and reduction and the residual risks are communicated to the project team for information and follow-up.

4.3   Risk management implementation in a project

Risk management requires corporate commitment in each actor's organization and the establishment of clear lines of responsibility and accountability from the top corporate level downwards. Project management has the overall responsibility for the implementation of risk management, ensuring an integrated, coherent approach for all project domains.

Independent validation of data ensures the objectiveness of risk assessment, performed as part of the risk management process.

Risk management is a continuous, iterative process. It constitutes an integral part of normal project activity and is embedded within the existing management processes. It utilizes the existing elements of the project management processes to the maximum possible extent.

4.4   Risk management documentation

The risk management process is documented to ensure that the risk management policies (see Annex A) are well established, understood, implemented and maintained, and that they are traceable to the origin and rationale of all risk–related decisions made during the life of the project.

The risk management documentation includes the risk management policy, which:

* defines the organization's attitude towards risk management, together with the project specific categorization of risk management, and

* provides a high-level outline for the implementation of the risk management process.

In addition to the risk management policy document, two key documents are established:

* risk management plan describing the implementation of the risk management process (see Annex B), and

* risk assessment report for communicating the identified and assessed risks as well as the subsequent follow-up actions and their results (see Annex C).

5
The risk management process

5.1 Overview of the risk management process

The iterative four–step risk management process of a project is illustrated in Figure 5-1. The tasks to be performed within each of these steps are shown in Figure 5-2.

Step 1 comprises the establishment of the risk management policy (Task 1) and risk management plan (Task 2) in coordination with other project disciplines, such as system engineering, product assurance, production, and operations, to ensure coherent approach to risk management across the programme/project. The risk management process includes full coordination between the disciplines of the programme/project.

> NOTE   E.g. System Engineering coordination, all engineering disciplines.
> Product Assurance coordination, Quality Assurance, Safety and Dependability disciplines.
>
> Management is responsible for overall coordination of all disciplines, including administration of business agreements and project control.

These tasks (1 and 2) are performed at the beginning of a project. The implementation of the risk management process consists of a number of "risk management cycles" over the project duration comprising the Steps 2 to 4, subdivided into the seven Tasks 3 to 9.

The period designated in the illustration with "Risk management process" comprises all the project phases of the project concerned. The frequency and project events at which cycles are required in a project (only three are shown in Figure 5-1 for illustration purposes) depend on the needs and complexity of the project, and need to be defined during Step 1. Unforeseen cycles are required when changes to, for example, the schedule, technologies, techniques, and performance of the project baseline occur.

Risks at any stage of the project are controlled as part of the project management activities.
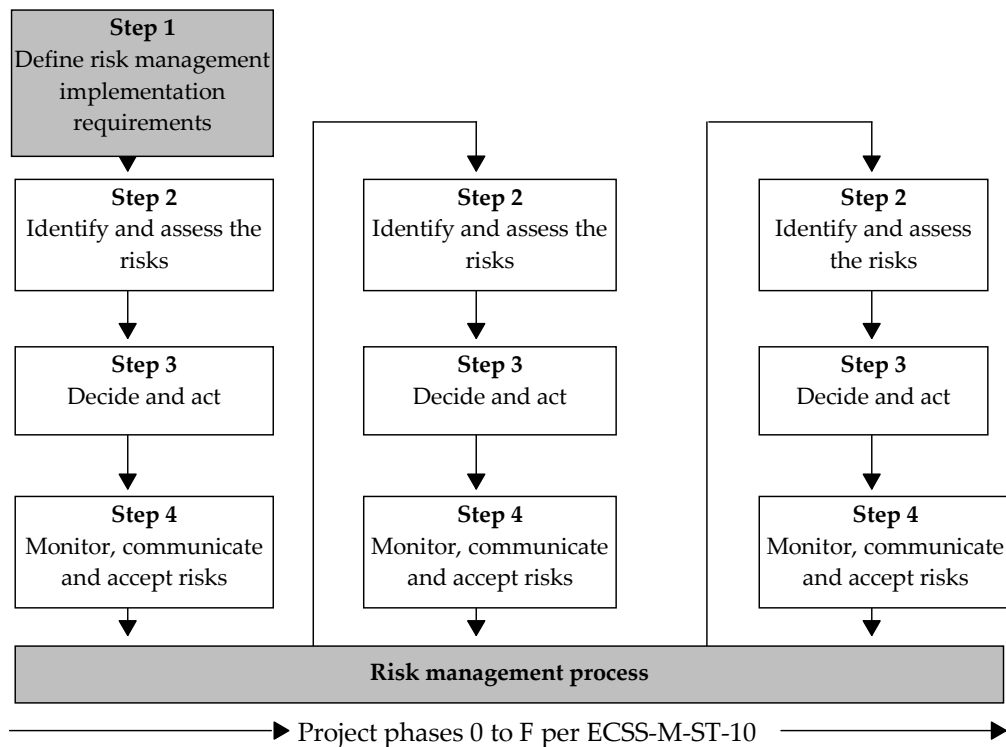
Figure 5-1: The steps and cycles in the risk management process
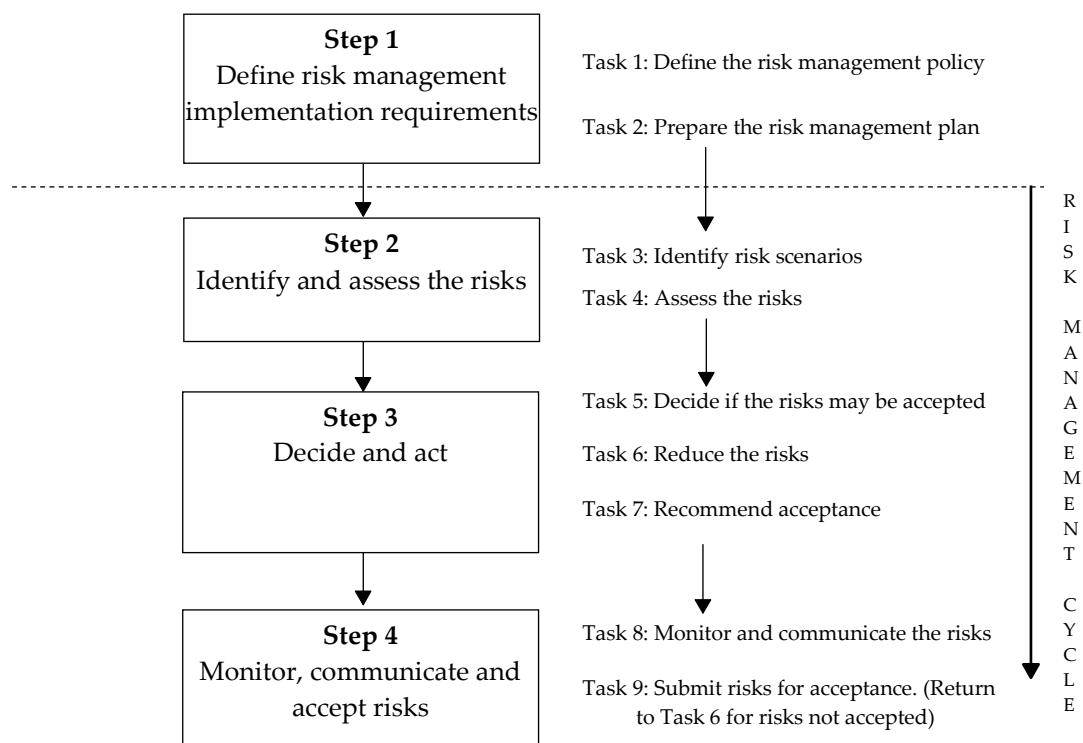
Figure 5-2: The tasks associated with the steps of the risk management process within the risk management cycle

5.2 Risk management steps and tasks

5.2.1 Step 1: Define risk management implementation requirements

5.2.1.1 Purpose

To initiate the risk management process by defining the project risk management policy and preparing the project risk management plan.

5.2.1.2 Task 1: Define the risk management policy

The following activities are included in this task:

a.   Identification of the set of resources with impact on risks.

b.   Identification of the project goals and resource constraints.

c.   Description of the project strategy for dealing with risks, such as the definition of margins and the apportionment of risk between customer and supplier.

d.   Definition of scheme for ranking the risk goals according to the requirements of the project.

e.   Establishment of scoring schemes for the severity of consequences and likelihood of occurrence for the relevant tradable resources as shown in the examples given in Figure 5-3 and Figure 5-4.

> NOTE   In the examples, five categories are used for illustration only; more or fewer categories or designations are also possible.

f.   Establishment of a risk index scheme to denote the magnitudes of the risks of the various risk scenarios as shown, for example in Figure 5-5.

> NOTE 1   Establishment of scoring and risk index schemas is performed with the full coordination between the different project disciplines to ensure complete and consistent interpretation.

> NOTE 2   In the example, risk magnitude categorization ("Red", "Yellow", "Green") is used for illustration only. Different designations are also possible

Score	Severity	Severity of consequence: impact on (for example) cost
5	Catastrophic	Leads to termination of the project
4	Critical	Project cost increase > tbd %
3	Major	Project cost increase > tbd %
2	Significant	Project cost increase < tbd %
1	Negligible	Minimal or no impact

Figure 5-3: Example of a severity–of–consequence scoring scheme

Score	Likelihood	Likelihood of occurrence
E	Maximum	Certain to occur, will occur one or more times per project
D	High	Will occur **frequently**, about 1 in 10 projects
C	Medium	Will occur **sometimes**, about 1 in 100 projects
B	Low	Will **seldom** occur, about 1 in 1000 projects
A	Minimum	Will **almost never** occur, 1 of 10 000 or more projects

Figure 5-4: Example of a likelihood scoring scheme

g. Establishment of criteria to determine the actions to be taken on risks of various risk magnitudes and the associated risk decision levels in the project structure (as in the example in Figure 5-6).

> NOTE   In the example, risk magnitude designation, acceptability, and proposed actions are used for illustration only. Project-specific policy definitions can be different.

h. Definition of risk acceptance criteria for individual risks.

> NOTE   The acceptability of likelihood of occurrence and severity of consequence are both programme dependent. For example, when a programme is advancing new research, technology development or management, a high probability of a consequence that quickly increase the cost can be acceptable.

i. Establishment of a method for the ranking and comparison of risks.

j. Establishment of a method to measure the overall risk.

k. Establishment of acceptance criteria for the overall risk.

l. Definition of the strategy for monitoring the risks and the formats to be used for communicating risk data to the decision–makers and all relevant actors in the project hierarchy.

m. Description of the review, decision, and implementation flow within the project concerning all risk management matters.

Likelihood

Risk Index:
Combination of
Severity and Likelihood

E	Low	Medium	High	Very High	Very High
D	Low	Low	Medium	High	Very High
C	Very Low	Low	Low	Medium	High
B	Very Low	Very Low	Low	Low	Medium
A	Very Low	Very Low	Very Low	Very Low	Low
	1	2	3	4	5	Severity

"Red"   "Yellow"   "Green"

Figure 5-5: Example of risk index and magnitude scheme

Risk index	Risk magnitude	Proposed actions
E4, E5, D5	Very High risk	Unacceptable risk: implement new team process or change baseline – seek project management attention at appropriate high management level as defined in the risk management plan.
E3, D4, C5	High risk	Unacceptable risk: see above.
E2, D3, C4, B5	Medium risk	Unacceptable risk: aggressively manage, consider alternative team process or baseline – seek attention at appropriate management level as defined in the risk management plan.
E1, D1, D2, C2, C3, B3, B4, A5	Low risk	Acceptable risk: control, monitor – seek responsible work package management attention.
C1, B1, A1, B2, A2, A3, A4	Very Low risk	Acceptable risk: see above.

Figure 5-6: Example of risk magnitude designations and proposed actions for individual risks

5.2.1.3   Task 2: Prepare the risk management plan

The risk management plan typically contains the following data:

a.   Description of the project risk management organization including its role and responsibility.

b.   Summary of the risk management policy.

c.   The risk management–related documentation and follow–up concept.

d.   The scope of risk management over the project duration.

5.2.2   Step 2: Identify and assess the risks

5.2.2.1   Purpose

To identify each of the risk scenarios, to determine then, based on the outputs from Step 1, the magnitude of the individual risks and, finally, to rank them. Data from all project domains are used (managerial, programmatic, technical).

> NOTE   List of examples of possible risk items:
>
> - **Technical**: Technology maturity; definition status of requirements, internal/external interfaces, payloads, operations; availability of margins, support team, project team; etc.
>
> - **Cost**: Overall project cost definition status; cost margins; insurance costs; availability of funding, independent cost assessment, industrial offers; human resources aspects; etc.
>
> - **Schedule**: Procurement planning; availability of planning of phases and activities interfacing with third parties; etc.
>
> - **Others**: Internal organisational aspects; public image; political constraints; risk sharing between actors; etc.

5.2.2.2   Task 3: Identify risk scenarios

The following activities are included in this task:

a.   Identification of the risk scenarios, including causes and consequences, according to the risk management policy.

b.   Identification of the means of early warning (detection) for the occurrence of an undesirable event, to prevent propagation of consequences.

c.   Identification of the project objectives at risk.

5.2.2.3   Task 4: Assess the risks

The following activities are included in this task:

a.   Determination of the severity of consequences of each risk scenario.

b.   Determination of the likelihood of each risk scenario.

c.   Determination of the risk index for each risk scenario.

d.   Utilisation of available information sources and application of suitable methods to support the assessment process.

e.   Determination of the magnitude of risk of each risk scenario.

f.   Determination of the overall project risk through an evaluation of identified individual risks, their magnitudes and interactions, and resultant impact on the project.

5.2.3 Step 3: Decide and act

5.2.3.1 Purpose

To analyse the acceptability of risks and risk reduction options according to the risk management policy, and to determine the appropriate risk reduction strategy.

5.2.3.2 Task 5: Decide if the risks may be accepted

The following activities are included in this task:

a.   Application of the risk acceptance criteria to the risks.

b.   Identification of acceptable risks, the risks that will be subjected to risk reduction, and determination of the management decision level.

c.   For accepted risks proceed directly to Step 4; for unacceptable risks proceed to Task 6.

5.2.3.3 Task 6: Reduce the risks

The following activities are included in this task:

a.   Determination of preventative and mitigation measures/options for each unacceptable risk.

b.   Determination of risk reduction success, failure, and verification criteria.

c.   Determination of the risk reduction potential of each measure in conjunction with the optimization of tradable resources.

d.   Selection of the best risk reduction measures and decision on priorities for implementation, at the appropriate decision making level in the project according to the risk management plan.

e.   Verification of risk reduction.

f.   Identification of the risks that cannot be reduced to an acceptable level and presentation to the appropriate management level for disposition.

g.   Identification of the reduced risks for which risk reduction cannot be verified.

h.   Identification of the risk reduction potential of all risk reduction efforts with respect to the overall risk.

i.   Documentation of the successfully reduced risks in a resolved risks list; and the unsuccessfully reduced risks in an unresolved risks list: present the latter to the appropriate management level for disposition.

5.2.3.4 Task 7: Recommend acceptance

The following activities are included in this task:

a.   Decision options for acceptance of risks.

b.   Approval of acceptable and resolved risks.

c.   Presentation of unresolved risks for further action.

5.2.4 Step 4: Monitor, communicate, and accept risks

5.2.4.1 Purpose

To track, monitor, update, iterate, and communicate, and finally accept the risks.

5.2.4.2 Task 8: Monitor and communicate the risks

The following activities are included in this task:

a. Periodical assessment and review of all identified risks and updating of the results after each iteration of the risk management process.

b. Identification of changes to existing risks and initiation of new risk analysis needed in order to decrease uncertainties.

c. Verification of the performance and effect of corresponding risk reduction.

d. Illustration of the risk trend over the project evolution by identifying how the magnitudes of risk have changed over project time.

e. An example of a risk trend for technical risks, which are main risk contributors at the first project milestone, is provided in Figure 5-7. S1, S2 and S3 are three risk scenarios.

   NOTE   In the example, the evolution of S1 shows that, in spite of risk reduction efforts, risk trend can worsen before improvement.

f. Communication of the risks and the risk trend to the appropriate level of management.

g. Implementation of an alert system for new risks.

Risk magnitude	Risk trend during project phases
Very High	S1
High	S2
Medium	
Low	S3
Very Low	
	Phase 1 Phase 2 Phase 3
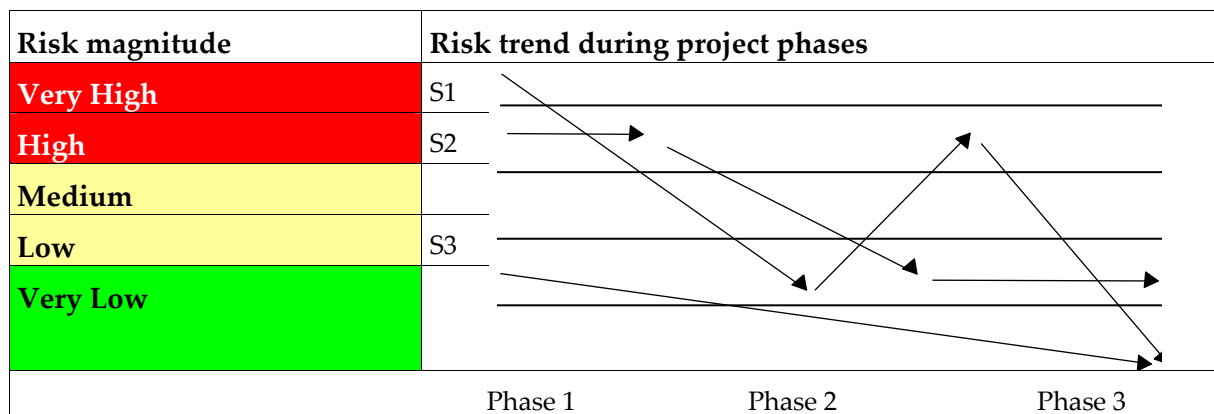
Figure 5-7: Example of a risk trend

5.2.4.3   Task 9: Submit risks for acceptance

The following activities are included in this task:

a.   Submission of the risks for formal risk acceptance by the appropriate level of management.

b.   Return to Task 6 for risks not accepted.

6
Risk management implementation

6.1   General considerations

a.   Risk management is performed within the normal project management structure, ensuring a systematic risk identification, assessment and follow-up of risks.

b.   Risk management is implemented as a team effort, with tasks and responsibilities being assigned to the functions and individuals within the project organization with the most relevant expertise in the areas concerned by a given risk. It is a collaborative effort of all project actors from the different disciplines.

c.   The results of risk management are considered in the routine project management process and in the decisions relative to the baseline evolution.

d.   Risk management draws on existing documentation as much as possible.

6.2   Responsibilities

The responsibilities for risk management matters within the project organization are described in the risk management plan in accordance with the risk management policy. The following approach applies:

a.   The project manager acts as the integrator of the risk management function across all concerned project domains. The project manager has overall responsibility for integrated risk management within a project and reports the results of the risk management task to the next higher level in the customer/supplier chain. The project manager defines who in the project is responsible for the control of the risks in their respective domains, and what their communication, information and reporting lines, and responsibilities are for risk management matters.

b.   Each project domain (such as engineering, software, verification, and schedule control) manages the risks emanating from its domain or being assigned to its domain for treatment, under the supervision of the project manager.

c.   Risks are formally accepted by the next higher level responsibility within the customer/supplier chain.

6.3 Project life cycle considerations

Risk management activities take place during all project phases. The following project activities are concerned with risk management:

a. Project feasibility studies, trades, and analyses (such as design, production, safety, dependability, and operations).

b. The allocation of tasks, manpower, and resources according to the ranking of risks.

c. The evolution of the technical concept through iterative risk assessment.

d. Evaluation of changes for risk impact.

e. The development, qualification, acceptance, and running of the project by using risk assessment as a diagnostic tool and for identifying corrective actions.

f. Assessment of the overall risk status of projects as part of all formal project reviews.

6.4 Risk visibility and decision making

a. Management processes and information flow within the project organization ensure a high visibility of the prevailing risk. Risk information is presented to support management decision making, including an alert system for new risks.

b. Action plans are prepared covering all outstanding risk items whose magnitudes are above the level specified in the project risk management policy to increase their visibility, to permit rapid decision making, and to ensure that their status is regularly reported to the relevant management level, and to all actors impacted by the risk consequences.

c. Information about all identified risks and their disposition is kept in a record.

6.5 Documentation of risk management

a. Risk management documents are maintained so that each step of the risk management process and the key risk management results and decisions are traceable and defensible.

b. The risk management process draws on the existing project data to the maximum extent possible, but documentation established specifically for risk management includes information on project–specific risk management policy; objectives and scope; the risk management plan; the identified scenarios; likelihood of events; risk results; risk decisions; records of risk reduction and verification actions; risk trend data; and risk acceptance data.

c. The data emanating from risk management activities are recorded in a risk management database containing all data necessary to manage risks and document the evolution of risks over the whole duration of the

project. The database is a living document, and is maintained current. Extracts from the database are presented at project meetings, reviews and milestones as required by the risk management plan. Items to be candidates for "lessons learned" are identified. The database is accessible to actors as appropriate.

NOTE   For example: the risk management database should support the efficient and effective management of critical areas of a program/project by:

- demonstrating that the risk management process is conducted in accordance with the defined process for project risk management;

- providing evidence of a systematic approach to risk identification and assessment;

- providing a record of risks;

- providing the decision makers with sufficient plans for approval;

- facilitating continuing monitoring and review of risk status;

- providing traceability;

- sharing and communicating required information within project actors;

- It includes all technical assessment by the various disciplines, as well as programmatic data.

- Example forms for the registration and ranking/logging of risk items are presented in Annex D to this Standard.

7
Risk management requirements

7.1 General

The requirements in this section are identified. Each identified requirement is composed of the wording of the requirement proper, and accompanied by an explanatory note attached to the general requirement.

7.2 Risk management process requirements

7.2.1

a. The basis for risk management shall be the four–step process and nine tasks illustrated in Figure 5-1 and Figure 5-2 of this document. The starting point for risk management shall be the formulation of the risk management policy at the beginning of the project in conformance with the DRD in Annex A.

> NOTE   The aim is to establish a risk management policy for the project concerned:
>
> - meeting customer requirements;
> - covering all project domains such as management, engineering, performance, schedule, and cost;
> - taking into account the project resources such as margins in schedule, cost, performance, and power;
> - establishing scoring and risk ranking criteria allowing actions and decisions on the treatment of individual and overall risks;
> - defining requirements for risk management.

7.2.2

a. A risk management plan shall be established by each supplier in conformance with the DRD in Annex B.

> NOTE   The aim is to assemble in a single document all elements necessary to ensure implementation of a

risk management commensurate with the project domains, organization, and management, while meeting customer requirements.

7.2.3

a. Risk scenarios shall be identified.

> NOTE The aim is to identify risk scenarios in a structured way for all domains (such as management, engineering, software, test, and operations), using available information sources such as:
>
> - previous analysis, lessons learned, and historical data;
> - expert interviews and experience data;
> - data extrapolation;
> - simulations, test data, and models;
> - detailed safety and dependability analysis (see ECSS-Q-ST-30 and ECSS-Q-ST-40);
> - analysis of all work breakdown structures and levels;
> - comparison of goals and plans;
> - analysis of resources;
> - analysis of suppliers;
> - analysis of proposed changes;
> - test results;
> - nonconformance reports;
> - time-frame consideration;
> - criticality of technology and availability of back-up solutions.

7.2.4

a. The risk scenarios shall be assessed.

> NOTE The aim is to facilitate understanding and comparison of the identified risk scenarios by applying the scoring method and scheme defined in the risk management policy.

7.2.5

a. The risk scenarios shall be analysed for their acceptability.

> NOTE 1 In the context of risk management, acceptance can mean that even though a risk is not eliminated, its existence and magnitude are acknowledged and tolerated.

NOTE 2   The aim is to identify acceptable risks, which are not subject to risk reduction, and unacceptable risks subject to risk reduction.

7.2.6

a.   Risks shall be reduced in accordance with the risk management policy.

NOTE   The aim is to reduce unacceptable risks to an acceptable level applying methods aiming at reducing the probabilities or severity of risk scenarios, or reducing the uncertainties in risk data, applying measures such as:

- modification of requirements or business agreement;

- change of design, baseline, or project structure;

- introduction of failure tolerance in accordance with ECSS-Q-ST-documents;

- acquisition of additional resources or redirection of resources;

- augmentation of test or analysis.

7.2.7

a.   The overall risk after consideration of the risk reduction shall be determined.

NOTE   The aim is to gain an understanding of the impact of potential risk mitigation actions.

7.2.8

a.   Options for acceptance of resolved, acceptable and overall risks shall be defined where appropriate and presented to the appropriate management level, as defined in the risk management plan, for disposition.

NOTE   The aim is determination and implementation of the appropriate risk resolution options.

7.2.9

a.   Unresolved risks shall be presented to the appropriate management level, as defined in the risk management plan, for further disposition.

NOTE   The aim is to arrive at a disposition of unresolved risks at the management level defined in the risk management plan.

7.2.10

a. Residual risks at the end of a risk management cycle shall be submitted to the appropriate management level, as defined in the risk management plan, for acceptance.

> NOTE   The aim is formal acceptance of residual risks at the appropriate management level.

7.2.11

a. Risks shall be monitored, communicated, and results shall be displayed in conformance with risk assessment report DRD, Annex C.

> NOTE   The aim is to ensure complete and systematic control of the implementation of risk management activities.

7.3   Risk management implementation requirements

7.3.1

a. Risk management shall be implemented at each level of the customer–supplier network.

b. At each level of the customer-supplier network, risk information received from lower level shall be integrated and assessed for reporting consolidated information.

> NOTE   The aim is to provide coherent risk management within the customer–supplier network.

7.3.2

a. Risk management shall be implemented in a cost–effective manner, using the existing project organization to the maximum extent.

> NOTE   The aim is to establish a coherent risk management structure, integrated into the project organization, with a view to obtaining benefits that outweigh the cost of risk management implementation.

7.3.3

a. The risk management process shall be monitored.

> NOTE   The aim is to provide visibility of the risk management process within the organization.

7.3.4

a. Lessons-learned exercise on the risk management process shall be performed.

> NOTE   The aim is continuous improvement of the risk management process.

7.3.5

a. Recognized improvements to the risk management process shall be implemented with the project progress.

> NOTE   The aim is to improve the risk management process.

Annex A (normative)
Risk management policy document - DRD

A.1   DRD identification

A.1.1   Requirement identification and source document

This DRD is called from ECSS-M-ST-80, requirement 7.2.1a.

A.1.2   Purpose and objective

The objective of the risk management policy document is to describe the objectives and principles of risk management in the context of the project and to give a high level outline of how we perform risk management, and what are the criteria for classification and acceptance of risks.

A.2   Expected response

A.2.1   Scope and content

<1>   Introduction

a.   The introduction shall describe the purpose and objective of the risk management policy document.

<2>   Applicable and reference documents

a.   The risk management policy document shall list the applicable and reference documents in support to the generation of the document.

<3>   Resources

a.   The risk management policy document shall describe the set of project resources that are affected by risk and thereby have an impact on the project objectives.

<4>   **Project goals and resource constraints**

a.   The risk management policy document shall describe the project objectives and the resource constraints of the project and name the project's critical success factors.

<5>   **Risk management strategy and approach**

a.   The risk management policy document shall provide an overview of the risk management approach, to include the status of the risk management effort, and a description of the project risk management strategy consistently deriving from the project's objectives.

b.   Margins should be stated and if relevant the apportionment of risk between customer and supplier.

<6>   **Ranking scheme for risk goals**

a.   The risk management policy document shall contain the definition of a ranking scheme for risk goals according to the requirements of the project.

<7>   **Scoring schemes**

a.   The risk management policy document shall state the scoring schemes for the severity of consequences and the likelihood of occurrence for the relevant tradable resources, e.g. as proposed in the standard.

<8>   **Risk index scheme**

a.   The risk management policy document shall contain the description of the method or tool by which the magnitudes of risks of the various risk scenarios are denoted.

<9>   **Action criteria**

a.   The risk management policy document shall state the criteria to determine the actions to be taken on risks of various magnitudes and the associated risk decision levels in the project structure e.g. as proposed in the standard.

<10>   **Individual risk acceptance**

a.   The risk management policy document shall describe the acceptance criteria for individual risks.

<11>   **Ranking and comparison of risks**

a.   The risk management policy document shall describe the method for the ranking and comparison of identified risk items where the ranking reflects on the potential direct consequence and impact of the risk to other risk areas or processes.

<12> Overall risk

a. The risk management policy document shall state the definition of the overall project risk, its measurement method and method of acceptance.

<13> Communication

a. The risk management policy document shall describe the strategy and the formats for communicating risk data to the decision makers and for monitoring the risks.

b. An escalation strategy should be described addressing how the information associated with each element of the risk management process is determined and made available to the participants in the process.

<14> Risk management process and procedures

a. The risk management policy document shall describe the risk management process to be employed i.e. the review, decision and implementation flow within the project concerning the risk planning, identification, assessment and identification, handling, monitoring and documentation functions.

b. The risk management policy document shall provide application guidance for each of the risk management functions in the process allowing the project's risk management organization flexibility while ensuring a common and coordinated approach to risk management and the coherence of the responsibilities and interfaces within the risk management process.

A.2.2 Special remarks

a. The response to this DRD may be combined with the response to the risk management plan DRD, ECSS-M-ST-80 Annex B.

Annex B (normative)
Risk management plan - DRD

B.1 DRD identification

B.1.1 Requirement identification and source document

This DRD is called from ECSS-M-ST-80, requirement 7.2.2a.

B.1.2 Purpose and objective

The objective of the risk management plan is to provide in a single document all elements necessary to ensure that the implementation of risk management commensurate with the project, organization, and management, while meeting customer requirements.

B.2 Expected response

B.2.1 Scope and content

<1> Introduction

a. The introduction shall describe the purpose and objective of the risk management plan.

<2> Applicable and reference documents

a. The risk management plan shall contain the list of applicable and reference documents, used to support the generation of the document.

<3> Organization

a. The risk management plan shall describe the risk management organization of the project

b. The risk management plan shall list the responsibilities of each of the risk management participants.

<4> **Risk management policy**

a. The risk management plan shall contain a link to the applicable risk management policy document.

<5> **Risk management documentation and follow-up**

a. The risk management plan shall describe the structure, the rules and the procedures used to document the results of the risk management and the follow-up process.

<6> **Project summary**

a. The risk management plan shall contain a brief description of the project, including the project management approach.

<7> **Description of risk management implementation**

a. The risk management plan shall describe how the risk management process is implemented.

<8> **Risk identification and assessment**

a. The risk management plan shall describe the identification and assessment process and procedures for examining the critical risk items and domains, and processes to identify and document the associated risks.

b. The risk management plan shall summarize the analysis process for each of the risk domain leading to the determination of an overall risk assessment.

c. The risk management plan should include the identification of specific metrics for risk assessment.

d. The risk management plan may include:

1. Overview and scope of the identification and assessment process;

2. Sources of information;

3. Information to be reported and formats;

4. Description of how risk information is documented;

5. Assessment techniques and tools.

<9> **Decide and act**

a. The risk management plan shall describe the risk treatment, which uses the risk assessment report as input.

b. The risk management plan should specify the criteria of risk acceptance beyond the risk management policy document and mitigation actions that can be used to determine and evaluate various risk handling options.

c.   The risk management plan should identify tools (i.e. name, version and date) that can assist in implementing the risk decision and acting process.

<10>   Risk monitoring and communication

a.   The risk management plan shall describe the operational approach that is followed to track, monitor update iterate and communicate the status of the various risks identified.

b.   The risk management plan should provide criteria for the selection of risks to be reported on, identify the reports to be prepared; specify the format; and assign responsibility for their preparation and the frequency of reporting.

c.   Operational escalation procedures should be stated in this clause ensuring a sufficient alert system and a structured manner of communication.

B.2.2   Special remarks

a.   The response to this DRD may be combined with the response to the risk management policy document DRD, ECSS-M-ST-80 Annex A

b.   The response to this DRD may be combined with the response to the project management plan, as in ECSS-M-ST-10.

Annex C (normative)
Risk assessment report - DRD

C.1 DRD identification

C.1.1 Requirement identification and source document

This DRD is called from ECSS-M-ST-80, requirement 7.2.11a.

C.1.2 Purpose and objective

The risk assessment report is the basis for communicating the identified and assessed risks, as well as the subsequent follow-up actions and their results.

C.2 Expected response

C.2.1 Scope and content

<1> Introduction

a. The assessment report shall introduce the following items:

    1. The purpose and objective of the risk assessment report;

    2. A brief description of what was done during the identification and assessment exercise, and its outcome;

    3. Identification of organizations that contributed to the preparation of the document.

<2> Applicable and reference documents

a. The risk assessment report shall contain the list of applicable and reference documents, used to support the generation of the document.

<3> Overview

a. The assessment report shall briefly describe what was done during the identification and assessment exercise.

<4>   Method of assessment

a.   The assessment report shall describe how the risks in question were identified, which inputs, method, tool(s) were used, and which people were involved.

<5>   Principle

a.   The assessment report shall describe the basics of the identification and assessment method (e.g. interviewing method), including the justification for the method(s) selected.

<6>   Consolidation

a.   The assessment report shall describe the consolidation approach for the overall risk assessment.

b.   The assessment report shall emphasize items of conflict and highlight the decisions that were taken for consideration in the overall assessment.

<7>   Assessment

a.   The assessment report shall give an appraisal of identified individual risks and the overall project risk.

<8>   Comparison with earlier assessments

a.   The assessment report shall describe results of the follow-up actions that were taken in comparison with earlier assessment(s).

<9>   Conclusions

a.   The assessment report shall describe the conclusions drawn from the identification and assessment, including any statements for future assessments and follow-up actions.

<10>   Annexes

a.   The assessment report shall contain the following information:

    1.   risk register (see ECSS-M-ST-80, Annex D);

    2.   ranked risk log;

    3.   rating scheme;

    4.   overall risk rating;

    5.   other analysis.

C.2.2   Special remarks

None.

Annex D (informative)
Risk register example and ranked risk log example

RISK REGISTER (Example)			
Project: WBS Ref.:	Organization:	Source: Controlled by: Supported by:	Date: Issue:

RISK SCENARIO and MAGNITUDE				
No.	Risk scenario title:			
Cause and consequence:				

Severity (S)					Likelihood (L)					Risk index	RED	YELLOW	GREEN	Risk domain
Negligible 1	Significant 2	Major 3	Critical 4	Catastrophic 5	Minimum A	Low B	Medium C	High D	Maximum E		(*)	(*)	(*)	(**)

RISK DECISION and ACTION		
Accept risk ❑		Reduce risk ❑
Risk reduction measures:	Verification means:	Expected risk reduction (severity, likelihood, risk index):
Action:		Status:

Agreed by project management: Name: Signature: Date:	Risk rank:

Notes

(*) Mark box as appropriate for the value of "R" (risk index), according to the criteria defined in the risk management policy.

(**) Indicate risk domain (e.g. technical, cost or schedule).

Project:		Organization:					Date:
							Issue:
Rank	No.	Risk scenario title	**Red**	**Yellow**	**Green**	Risk domain	Actions and status
			(*)	(*)	(*)	(**)	

Notes

(*) Mark box as appropriate for the value of "R" (Risk index) from the risk register, according to the criteria defined in the risk management policy.

(**) Indicate risk domain (e.g. technical, cost or schedule).

Annex E (informative)
Contribution of ECSS Standards to the risk management process

E.1 General

Other ECSS Standards contain requirements relevant to the risk management process. The main domains covered in level 1 and 2 standards are listed below.

E.2 ECSS-M ST-Standards

- ECSS-M-ST-10,:

    — Partitioning the project into technical and manageable elements ensures that items or tasks at risk can be unambiguously identified and allocated, and interfaces contributing to risk identified.

    — Partitioning the project into phases with reviews at critical project stages provides significant events for reviewing the identified risks and eventually assessing new risk scenarios evolving with the project progress, applying the risk assessment policy adopted for the project.

- ECSS-M-ST-40: The configuration and information management ensures that all documentation and data of relevance for the risk management process are available and controlled in a systematic manner.

- ECSS-M-ST-60: Controlling the schedule and cost of the project ensures that deviations with a bearing on identified risks are detected and remedied, or that risks can be re–assessed in the light of these deviations.

- ECSS-M-ST-70: The logistics support analysis contributes to risk management by providing the data underlying the assessment of risks influenced by operations, maintenance and disposal of the project hardware and software items.

E.3 ECSS-Q Standards

- ECSS-Q-ST-10, ECSS-Q-ST-20: The control over product quality ensures that the products affected by risk management are controlled to meet their specifications.

- ECSS-Q-ST-30, ECSS-Q-ST-40: The dependability and safety related activities apply where risks are linked to dependability and safety.

- ECSS-Q-ST-60, ECSS-Q-ST-70: The choice of EEE components, material, mechanical parts and processes influence the function and dependability of the design and have therefore an impact on risks.

- ECSS-Q-ST-80: The correct functioning of software has an influence on risks related to the functioning of the system.

E.4   ECSS-E Standards

- ECSS-E-ST-10: The engineering and system engineering processes provide a breakdown of engineering activities into manageable and controllable entities, and the demonstration of achievement of the customer's technical requirements. They are essential for identifying and assessing technical risks, and the verification of requirements with a bearing on risk.

- ECSS-E-ST-20 to ECSS-E-ST-70: The design of electronic and electrical, mechanical, communications, control and ground support systems and their software as well as of the overall system software has an influence on risks related to the functioning of the system.

Bibliography

ECSS-S-ST-00	ECSS system – Description, implementation and general requirements
ECSS-M-ST-40	Space project management –Configuration and information management
ECSS-M-ST-60	Space project management – Cost and schedule management
ECSS-M-ST-70	Space project management - Integrated logistic support
ECSS-Q-ST-10	Space product assurance – Product assurance management
ECSS-Q-ST-20	Space product assurance – Quality assurance
ECSS-Q-ST-30	Space product assurance — Dependability
ECSS-Q-ST-40	Space product assurance — Safety
ECSS-Q-ST-60	Space product assurance – Electrical, electronic and electromechanical (EEE) components
ECSS-Q-ST-70	Space product assurance – Materials, mechanical parts and processes
ECSS-Q-ST-80	Space product assurance – Software product assurance
ECSS-E-ST-10	Space engineering – System engineering general requirements
ECSS-E-ST-20	Space engineering –Electrical and electronic
ECSS-E-ST-40	Space engineering – Software general requirements
ECSS-E-ST-50	Space engineering – Communications
ECSS-E-ST-70	Space engineering – Ground systems and operations