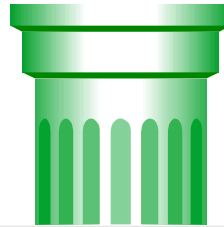

Software Product Assurance Process Implementation

Abstract

SPA process implementation involves setting up the management, organizational, and procedural elements to ensure the effective execution of SPA activities across the software lifecycle. This module introduces the participant to the content and rationale of the relevant requirements contained in section 5 of the ECSS-Q-80B Standard.

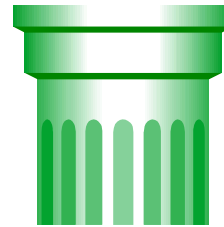
SPA programme implementation

Software product assurance programme implementation



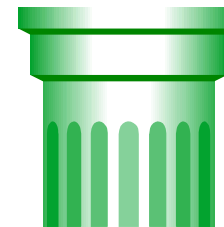
Focus on issues in setting up and running an SPA programme - Requirements on SPA management

Software process assurance



Focus on adequate definition and execution of software engineering processes and activities

Software product quality assurance



Focus on software product quality requirement definitions and achievements

Organization and Responsibility

Requirements in Organisation and Responsibility

Software product assurance process implementation



Software product

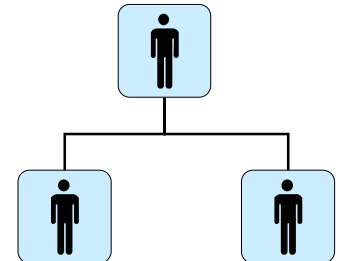
- 6.1 Software development
- 6.2 Requirements engineering
- 6.3 Requirements software engineering

5.2 Organization and responsibility

- 5.2.1 Organization
- 5.2.2 Responsibility and authority
- 5.2.3 Resources
- 5.2.4 Software product assurance manager
- 5.2.5 Training

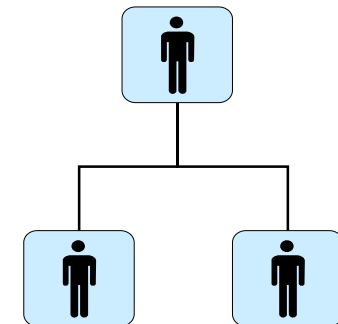
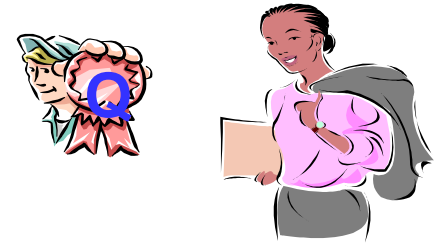
Resources, Organization and Responsibility

- The supplier shall identified SPA resources requirements and provided them according to SPA tasks
- The organizational structure of both personnel and work affecting quality must be clearly defined and documented
- The definition of the organization structure encompasses a set of key aspects:
 - Roles
 - Setting up lines of authority
 - Defining responsibilities
 - Interfaces to other organizations (internal and external)
 - Interrelationships among roles within the organization



The Software PA Manager

- One person must be appointed as software product assurance manager for the project
- The appointed SW PA Manager must have sufficient organisational authority and independence
 - to propose and maintain a product assurance programme
 - to have unimpeded access to higher management through the company PA executive
- The software product assurance manager generally reports to the project manager via the product assurance manager. He or she liaises with the software engineers and dependability and safety engineers.
- In a **large project**, product assurance organization at system level is mirrored at software level.



Contractual Aspects

Contractual Aspects in ECSS-Q-80B

Software product assurance process implementation

5.2 Organization and responsibility

5.6 Supplier selection and control

5.3 Contractual aspects

5.7 Procurement

5.4 SPA programme management

5.8 Tools and supporting environment

5.5 Risk management and configuration control

5.9 Assessment and improvement process



Software product

5.3 Contractual aspects

6.1 Software development

6.2 Requirement engineering

6.3 Requirement software engineering



Requirement

ECSS-Q-00A subclause 3.3.4 is applicable.

7.5 Firmware

Software product assurance programme management

Key Sections in SPA Programme Management

Software product assurance process implementation

5.2 Organization and responsibility

5.6 Supplier selection and control

5.3 Contractual aspects

5.7 Procurement

5.4 SPA programme management

5.8 Tools and supporting environment

5.5 Risk management and critical

Software process implementation

6.1 Software development life-

6.2 Requirements applicable to engineering processes

6.3 Requirements applicable to software engineering activities

5.4 SPA programme management

5.4.1 Software product assurance planning and control

5.4.2 Software product assurance reporting

5.4.3 Audits

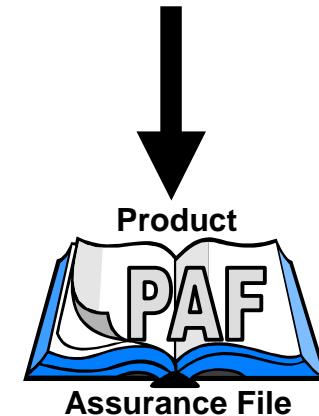
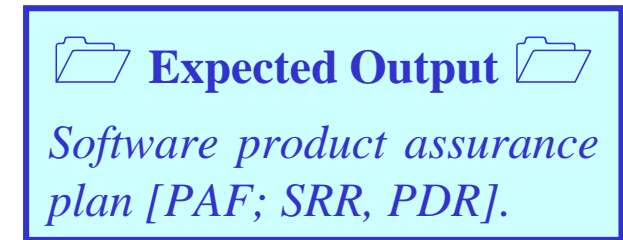
5.4.4 Alerts

5.4.5 Nonconformances

5.4.6 Software problems

The Software Product Assurance Plan

- The SPA plan may be included in the system product assurance plan
- The supplier must develop a **software product assurance plan** in reply to the software product assurance requirements
- The SPA plan is subject of **approval by the customer**
 - In this regard, recall the *recursive customer-supplier relationship* – therefore this SPA plan approval process holds **throughout the customer-supplier chain**
- The supplier must also provide a **compliance matrix** demonstrating compliance with the individual requirements of the project
- The SPA plan must be **updated at each milestone**



Contents of SW Product Assurance Plan

The SW PA Plan must specify or reference to:

- ✓ quality objectives in measurable terms whenever possible
- ✓ SW development life cycle, the related milestones and the input and output criteria for each development phase
- ✓ types of verification and validation activities (including tests)
- ✓ detailed planning of V&V activities (including tests), indicating schedules, resources and approval authorities
- ✓ specific responsibilities for quality activities (e.g. reviews, test, configuration management and change control, etc.)
- ✓ methods, tools and rules to be applied
- ✓ procedures for determining the criticality category of software processes, functions, objects, packages, units, files
- ✓ specific actions and measures for supplier control



Software Product Assurance Reporting

- ECSS-Q-80B covers the following **supplier controls** :
 - SPA reporting
 - Audits
 - Alerts
 - Non-conformances
 - Software problems



Expected outputs of these activities go into Product Assurance File

SPA status reporting is governed by overall QA status reporting



SPA Status and Progress Report

- SPA Status Reporting includes an assessment of:
 - the current quality of software development processes.
 - the current quality of the product, based on measured properties, verifications undertaken, problems detected and problems resolved
- The assessment must be made with reference to the metrication as defined in SPA Plan
- The software product assurance reporting can be included in the system product assurance reporting.





SPA reporting must be performed throughout the entire lifecycle

SPA Audits

- The supplier shall establish and maintain an **audit plan** for procurement activities on the project
- The audits shall be performed on:
 - designating lower tier supplier to be audited
 - the current status of the project
- The audits shall be scheduled
- The customer shall have both the right to be represented in the planned external audit and to audit any lower-tier supplier
- Additional and/or unplanned audits are performed when necessary

Quality
Q-20B
Assurance

***The SPA auditing rules
in ECSS-Q-20B***

 **Expected Output** 
Audit plan and schedule [PAF; SRR].



Product

Assurance File

Alerts and the Alert System

- **Alerts** prompt exchange of information on failures or problems that can affect more than one user or can recur in other projects, if no preventive actions are taken
- The final customer must establish an alert system, in which lower-tier suppliers participate
- The system must provide for:
 - ✓ **Notification of preliminary alert information** is propagated up the supplier chain
 - ✓ **Investigation of failure** by the final customer
 - ✓ **Alerts** are issued by the customer to the participants in the alert system

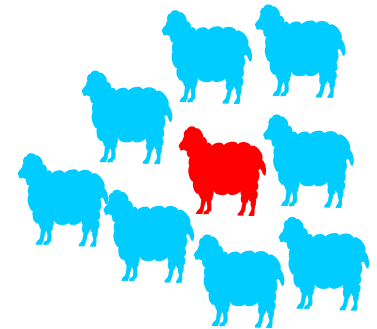


Quality
Q-20B
Assurance

***The alert system is specified
in ECSS-Q-20B***

Nonconformances

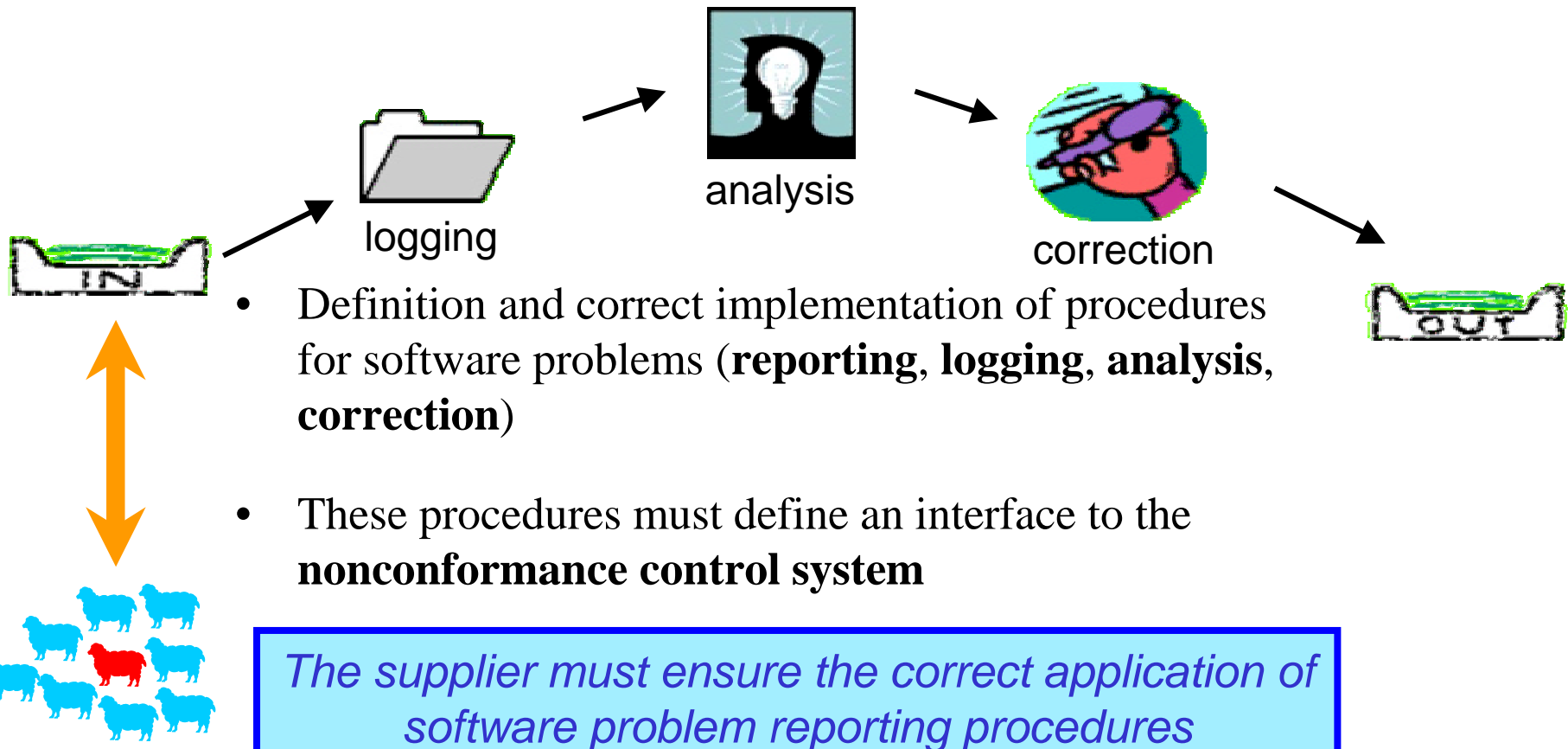
- The supplier must implement a nonconformance control system
- The system must provide for:
 - Identification and segregation of nonconformances
 - Recording, reporting, review, disposition and analysis of nonconformances
 - Definition and implementation of corrective and preventive actions
- Nonconformances must be classified as major or minor (if doubt => major), based on the severity of their consequences
- Major nonconformances must be notified to the customer



Nonconformance
Q-20-09B
Control System

**Clarifications, recommendations and guidelines
In ECSS-Q-20-09B (level-3 standard)**

Software Problem Reporting Procedures



Risk management and critical item control

Risk Management and Critical Item Control

Software product assurance process implementation

5.2 Organization and responsibility

5.6 Supplier selection and control

5.3 Contractual aspects

5.7 Procurement

5.4 SPA programme management

5.8 Tools and supporting environment

5.5 Risk management and critical item control

5.9 Assessment and improvement process



Software process assurance

Software product quality assurance

6.1 Software development lifecycle

7.1 Product quality objectives and metrication

6.2 Requirements engineering

6.3 Requirements software engineering

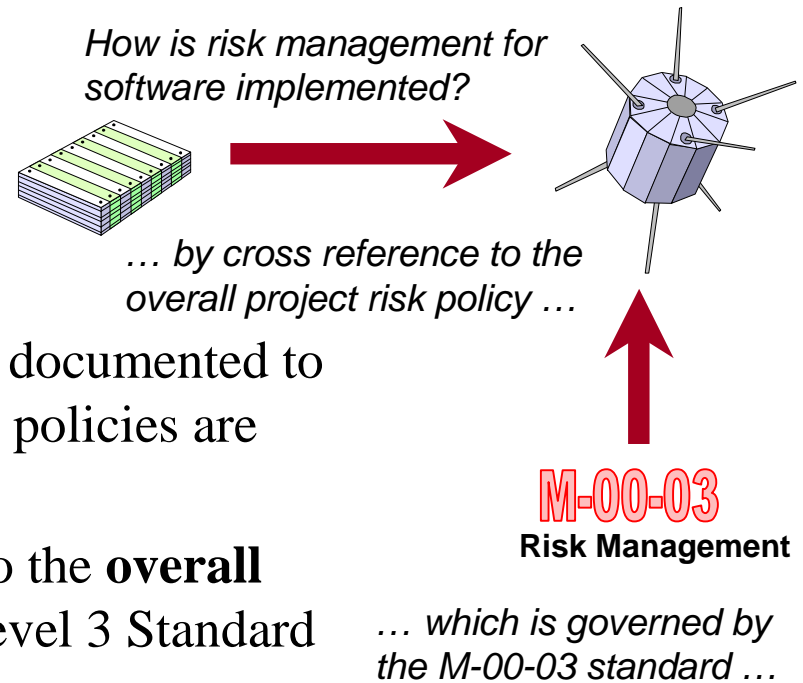
5.5 Risk management and critical item control

5.5.1 Risk management

5.5.2 Critical item control

Risk Management

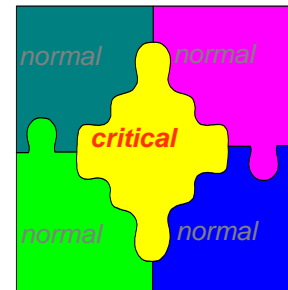
- The software risk assessment, reduction and control process includes inputs from **all** SPA disciplines (managerial, technical and programmatic)
- The software risk management process is documented to ensure that the software risk management policies are established, implemented and maintained
- Software Risk Management contributes to the **overall project risk policy**, as specified in the Level 3 Standard M-00-03



The risk management process is continuous and iterative throughout the project life cycle

Critical Item Control

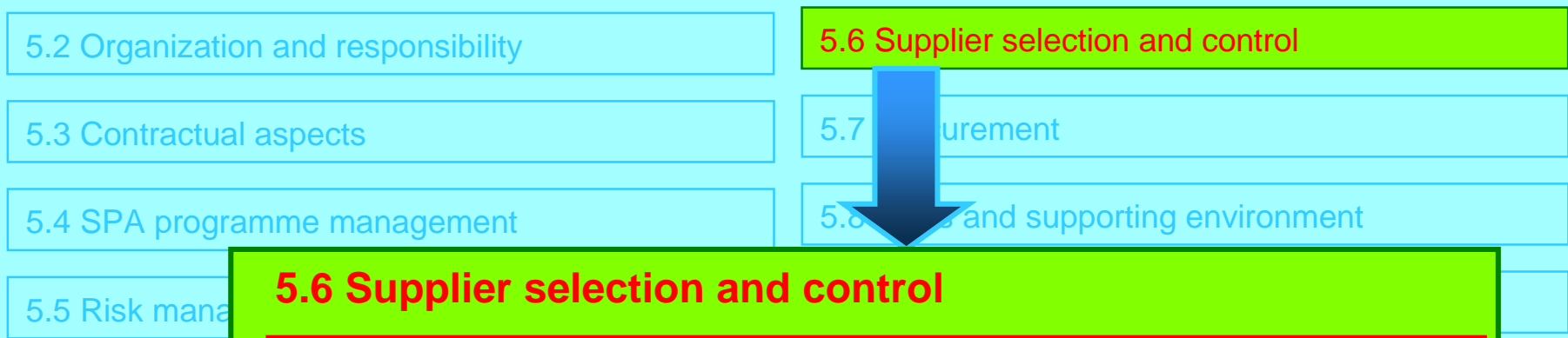
- The project defines the criteria for critical item identification
- All identified technical risks must be assessed for the severity of their consequences, and then categorized accordingly
- The process of risk identification and assessment employs both qualitative and quantitative approaches
- The risks identified by dependability and safety analysis must be systematically considered
- Critical item control is implemented as a result of risk assessment



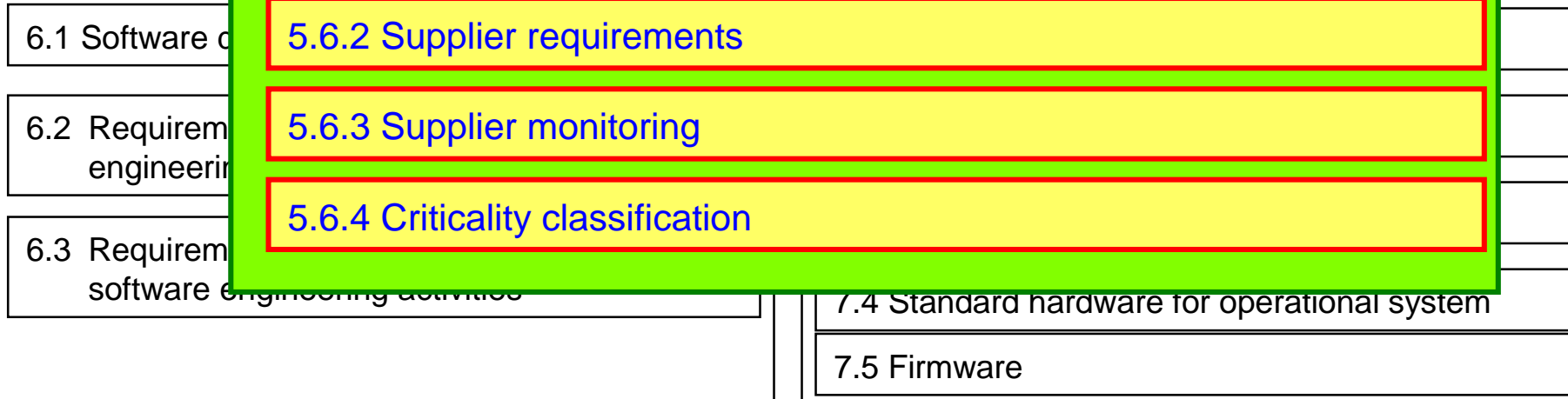
Supplier Selection and Control

Key Aspects of Subcontractor Selection & Control

Software product assurance process implementation

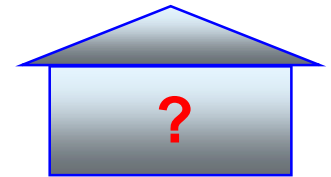


Software product



Selecting a Supplier

- The basis criteria for selecting **suppliers** are:
 - The supplier has been qualified by the final customer
 - The supplier has been furnishing products with the quality required
 - The supplier has continuously demonstrated capability to furnish in the past
 - Supplier capability is demonstrated by a pre-award audit by the relevant customer
- Also based on internationally recognized approaches such as ISO/IEC 15504



***Determining
supplier
capabilities***

Quality
Q-20B
Assurance

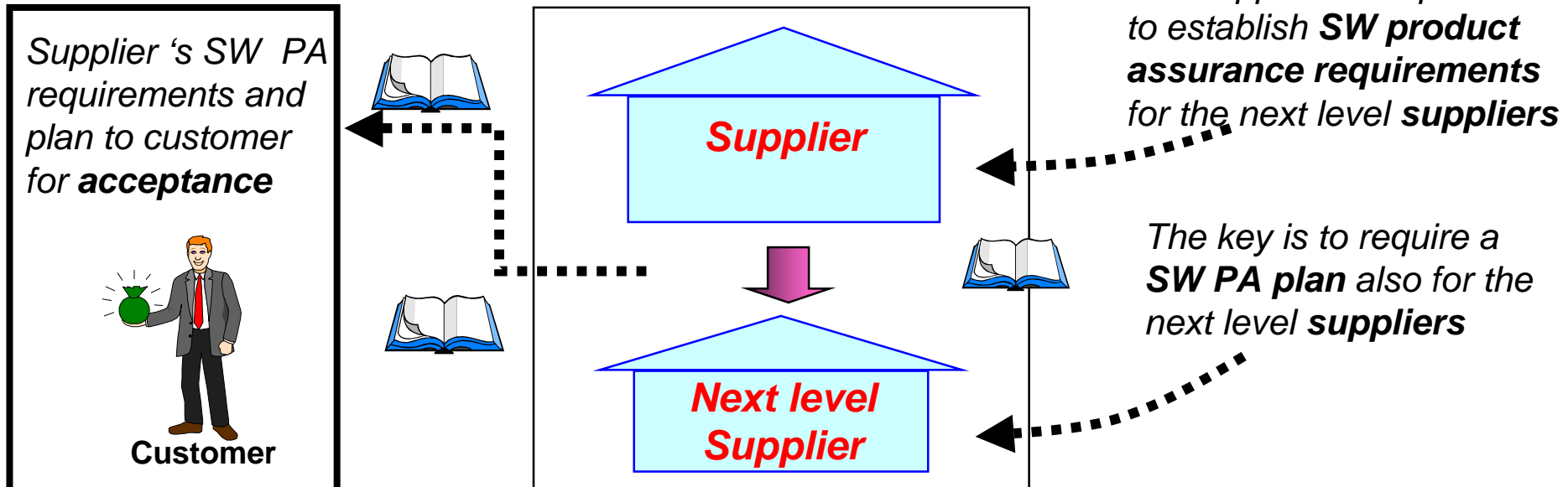
***ECSS-Q20B sub-clause 7.2 is
applicable for supplier selection***

SPA Requirements for Suppliers

- Each supplier, in his role of customer, must define **SW product assurance requirements** for next level suppliers
 - including a requirement to produce a SW product assurance plan
- The SW product assurance requirements for suppliers must be compatible with SPA requirements imposed by the customer
- The SW product assurance requirements for suppliers must be provided to the customer for approval

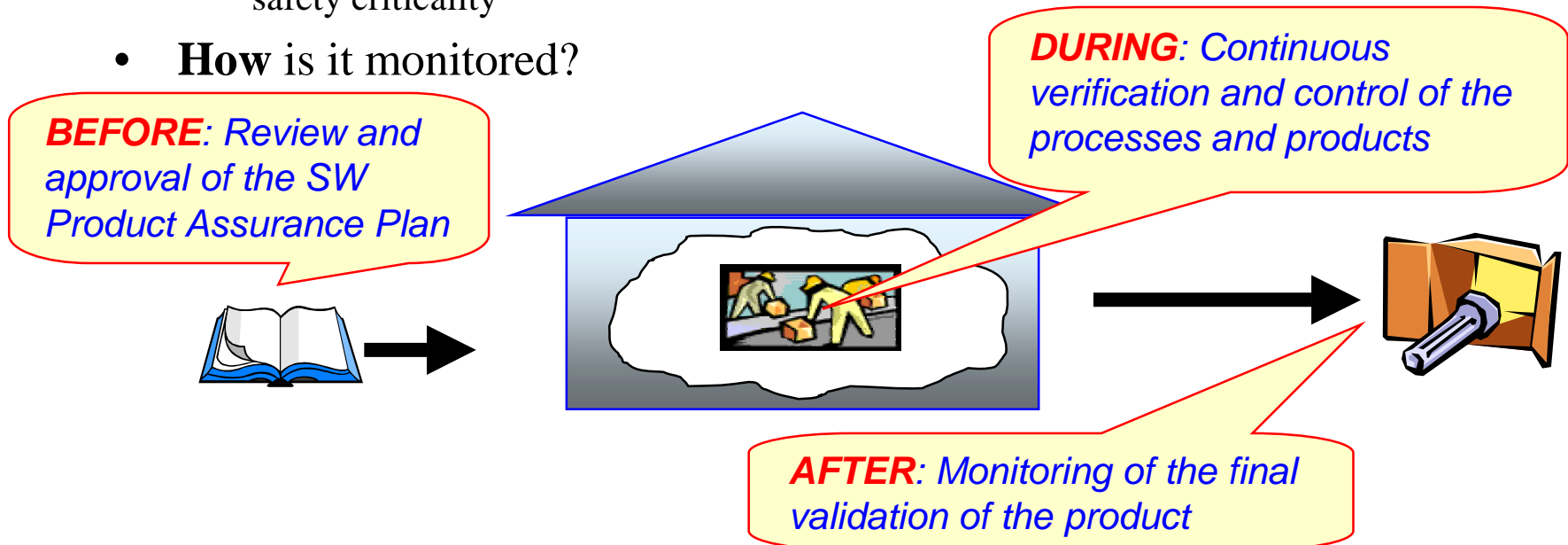
Supplier SW Product Assurance Plan

- A key aspect of supplier management is the requirement that the supplier produce a **SW product assurance plan**
- The requirements placed by the supplier on the next level suppliers, as well as the supplier's SW PA plan, must be presented to the **customer for acceptance**



Supplier Monitoring

- **What** is monitored?
 - Supplier monitoring concerns the next level supplier's conformance to the SW product assurance requirements throughout the project life cycle
 - To ensure that procured software is correctly classified for dependability and safety criticality
- **How** is it monitored?



Procurement

Key Aspects in Procurement

Software product assurance process implementation

5.2 Organization and responsibility

5.6 Supplier selection and control

5.3 Contractual aspects

5.7 Procurement

5.34 SPA program

5.7 Procurement

supporting environment

5.5 Risk management

management process

Software product

Product quality assurance

6.1 Software development

quality objectives and metrication

6.2 Requirement engineering

quality requirements

6.3 Requirement software

g documentation

hardware for operational system

5.7.1 Requirements

5.7.2 Selection

5.7.3 Approval

5.7.4 Procurements details

5.7.5 Identification

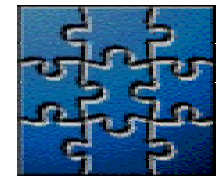
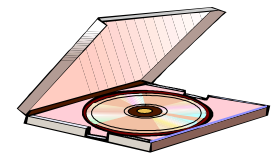
5.7.6 Inspection

5.7.7 Exportability



Procurement Process

- Requirements on procurement applies to projects using:
 - Off-the-Shelf (**OTS**)
 - Commercial Off-The-Shelf (**COTS**)
 - Modified-Off-The-Shelf (**MOTS**)
- The use of procured software is considered as a **reuse of existing software**, and therefore the requirements of subclause 6.2.7 are applicable for the **selection** of OTS, COTS or MOTS software components to be used or integrated into the system
- The choice of procured software must be described and submitted for **customer approval**



IEEE 1062 Recommended Practice for Software Acquisition

Software Procurement Process

Selection

Requirements concern the assessment of the product, licensing conditions, maintenance responsibility and conditions, criticality, exportability constraints, etc.

Inspection

Planned receiving inspection against predefined criteria before acceptance

Approval

Customer approval of a SW component list including: ordering criteria (e.g. versions, options); arrangements for maintenance and upgrades, backup solutions, contractual arrangements

The SW must be identified and registered by configuration management

Identification

Tools and supporting environment

Key Aspects of Tools and Supporting Environment

Software product assurance process implementation

5.2 Organization and responsibility	5.6 Supplier selection and control
5.3 Contractual aspects	5.7 Procurement
5.4 SPA programme management	5.8 Tools and supporting environment
5.5 Risk management and critical item control	5.9 Assessment and implementation process

5.8 Tools and supporting environment

5.8.1 Development computer selection

5.8.2 Choice description

5.8.3 Methods and tools

5.8.4 Tool selection



Quality assurance

Quality objectives and metrication

Quality requirements

Documentation

Hardware for operational system

7.5 Firmware

Development Computer Selection

- The choice of the development equipment must be described in the Software Development Plan
- The choice should be performed according to several criteria, e.g. :
 - **Criticality category** – is the computer development equipment appropriate for the criticality requirements of the developed SW?
 - **Performance** – Unix workstation needed? PC? Both types?
 - **Long project life** – Is computer maintenance, evolution, durability guaranteed for life of project?
 - **Standard commercial considerations** such as warranties, training, acceptance conditions, support documentation
 - **Other technical considerations** – Is it consistent with the operational equipment? Is it compatible?

Methods and Tools

- Mature **methods and tools** must be used for all activities of the development cycle
- The choice of development methods and tools must be **justified** by demonstrating that:
 - they suit the functional and operational characteristics of the product
 - they are available throughout development and maintenance of the product
 - development team has appropriate experience or training
- Suitability of selected methods and tools can be **demonstrated** through testing or documented assessment



Assessment and Improvement Process

Key Aspects of Assessment and Improvement

Software product assurance process implementation

5.2 Organization and responsibility

5.6 Supplier selection and control

5.3 Contractual aspects

5.7 Procurement

5.4 SPA programme management

5.8 Tools and supporting environment

5.5 Risk management and critical item control

5.9 Assessment and improvement process

5.9 Assessment and improvement process

5.9.1 Assessment process

5.9.5 Quality data

5.9.2 Assessment procedure

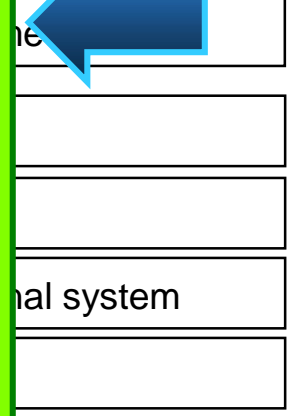
5.9.6 Process improvement

5.9.3 Assessment records

5.9.7 Process or project documentation

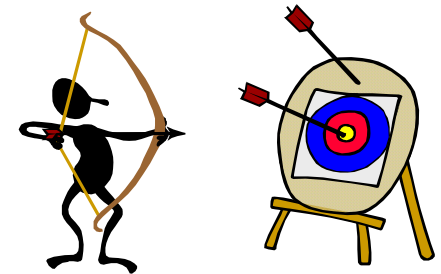
5.9.4 Assessment data

ance



Assessment Process and Improvement

- The supplier must monitor and control the effectiveness of the processes used during the software development. **Assessment process** includes:
 - Define software process assessment plan
 - Develop, document and apply a process assessment procedure
 - Collect and analyse data
 - Keep and maintain assessment records
- **Process Improvement** can be initiated by implementing actions using the feedback from the assessment procedure and records



ECSS-Q-80-02 provides guidelines on “**Software process assessment and improvement**”

Summary

- SPA process implementation is an important prerequisite to the effective functioning of the lifecycle SPA activities
- Some elements of process implementation are carried out at the beginning of a project
 - Setting up the organizational, authority, role infrastructure
 - Putting in place audit, nonconformance, problem reporting systems
 - Putting in place quality model and metrication
- However, all elements of process implementation are intended to be carried out **over the entire lifecycle of the project**, including those set up at the beginning