VDA

Verband der Automobilindustrie

ProSTEP iViP

White Paper

Engineering Change Management Reference Process

covering ECM Recommendation V2.0

Version 2.0, issued Aug. 2009
Replacements: Version 1.0

Engineering Change Management Reference Process

covering VDA 4965 V3.0

Version 3.0, issued Jan. 2010
Replacements: no replacement

SASIG
strategic automotive product data standards industry group

A Joint Publication

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FOREWORD

This document is an addendum which provides an explanation of the SASIG ECM Reference Process. Its purpose is to describe additional aspects which are not explicitly covered by the SASIG ECM Recommendation due to various reasons, but which seems to be necessary in order to get familiar with the ideas behind the SASIG ECM Recommendation.

The representation of the SASIG ECM Reference Process (in IDEF0 notation, a United States Department of Defense Standard for the definition of Processes) contained in this document reflects the understanding of the SASIG ECM Working Group about the whole SASIG ECM Reference Process and its sub-processes on level 1, e.g. Engineering Change Request (ECR) and Engineering Change Order (ECO) processes.

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Abstract

This document is an overview of the SASIG ECM Reference Process. The purpose of this document is to further elaborate on and cover topics not specifically addressed by the SASIG ECM Recommendation. The SASIG ECM WG feels that additional simplification will help the end users better understand the strategy and thought process behind the SASIG ECM Recommendation.

The SASIG ECM Reference Process (in IDEF0 notation) covered in this documents reflects the collective, consensus based position taken by the global SASIG Work Group on the said Reference Process and all it's sub-process on level 1 e.g. Engineering Change Request (ECR) and Engineering Change Order (ECO). Details and special cases (back jumps and iterations) are not shown intentionally because all such details are covered in the SASIG ECM Recommendation.

This IDEF0 notation is not a substitute to the detailed ECM Reference Process outlined in The SASIG ECM Recommendation, which is the Master Document.

The term "Reference Process" is used to emphasize the fact that the ECM Process here is not intended to reflect any in-house ECM Process of any contributing member companies.

Overview

White paper goal: to provide general information which is not explicitly covered by the SASIG ECM Recommendation. This addendum is designed to further simplify the understanding and the scope of the SASIG ECM Recommendation.

White paper status: This release covers the scope defined by the SASIG ECM Recommendation. The maintenance of this document is the sole responsibility of the SASIG ECM Working Group. Issues and concerns regarding this document should be forwarded to the points of contact identified in the maintenance section of this document.

Intended audience: All ECM Process Owners within the global automotive supply chain.

Intended use: to describe the scope of the SASIG ECM Recommendation and to contribute to the common understanding and the common terminology of the SASIG ECM Reference Process.

White paper structure: the overall scope of this document is partitioned into a set of chapters corresponding to needs identified for providing background information on the SASIG ECM Recommendation. Within a chapter, there may be sections and sub-sections. These sections and sub-sections further divide the scope covered by the chapter into smaller components of coherent functionality that interact with each other to realize the functionality of the entire chapter. The chapters are:

- The SASIG ECM Evolution Process: semantic net of the working context of the SASIG ECM WG
- IDEF0 – Short Overview: short introduction into the IDEF0 notation.
- SASIG ECM Reference Process Synopsis: provides on overview of the scope of the SASIG ECM Reference Process and revealing the major dependencies of its phases
- IDEF0 Representation of the SASIG ECM Reference Process: provides a detailed top-down decomposition of the SASIG ECM Reference Process using the IDEF0 notation as well as the definition of the major activities including inputs and outputs.

Assumptions

The authors of this document act on the assumption that the reader of this document is familiar with their internal Engineering Change Management processes.

Basic Definitions

The following definitions apply in the scope of this document:

Product

- item that is offered to the market

Product Definition Data

- collection of data necessary to precisely defined the Product as designed

Entity

- a person(s), department or an organization

Product Owner

- Entity that possesses a Product i.e. that is responsible for the Product

Engineering Change

- a modification of the Product Definition Data of a Product, factoring in the urgency, impact, and complexity of the change

Process Owner

- Entity that defines and possesses a process

ECM Process Owner

- Entity that “defines” and “possesses” an ECM process
- a Process Owner belongs to the product owner

ECM Process

- the coordinated management and uniform tracking of Engineering Changes, starting with the identification of potential for change and ending with the manufacturing implementation of change

Coordinator

- Entity responsible for managing an Engineering Change
- this Entity is equal to or is authorized by the Product Owner of the Product that should/will be changed

Participant

- Entity involved in the processing of an Engineering Change
- typically, a supplier that is responsible for one or more parts that are/will be changed play the role of an Participant

EC Manager

- Entity that oversees and is responsible for the processing of an Engineering Change
- the EC Manager reports to the Coordinator

Acronyms

The following acronyms are used within this document (alphabetical order):

AS	▪ *Alternative Solution*
BOM	▪ *Bill of Material*
ECM	▪ *Engineering Change Management*
ECO	▪ *Engineering Change Order*
ECR	▪ *Engineering Change Request*
ICOM	▪ *Input, Control, Output, and Mechanism*
IDEF0	▪ *Integrated Definition for Function Modelling*
IM	▪ *Issue Management*
OEM	▪ *Original Equipment Manufacturer*
MCO	▪ *Manufacturing Change Order*

1 THE SASIG ECM EVOLUTION PROCESS

The following figure (Figure 1) illustrates working dynamics of the SASIG ECM Working Group. This committee, representing North American, European and Asian auto industry, produces the SASIG ECM Recommendation.

Starting point and foundation for this document is the ECM Recommendation of the VDA (VDA 4965, Version 2.0), which itself is produced by the joint ECM Working Group of the VDA and the ProSTEP iViP Association. The ProSTEP iViP Association is an international sectored community comprising leading companies in the automotive and aerospace industries, system vendors and research institutes: emphasis is put hereon the unobstructed interaction of product data, systems and processes. In addition to the development of open standards like STEP (ISO 10303) and OMG PLM Services more and more emphasis is put on the creation of processes as well as the controlling of projects cutting across departments, companies or countries - Collaborative Product Visualization, Collaborative Project Management, Engineering Change Management, Requirements Management, and Enterprise Rights Management. ProSTEP iViP is a liaison member of SASIG.

Members of the SASIG ECM Working Group are:

- AIAG (Automotive Industry Action Group, United States)
- GALIA (Groupement pour l'Amélioration des Liaisons dans l'Industrie Automobile, France)
- JAMA (Japan Automobile Manufacturers Association, Japan)
- ODETTE Sweden, and
- VDA (German Association of the Automotive Industry, Germany)

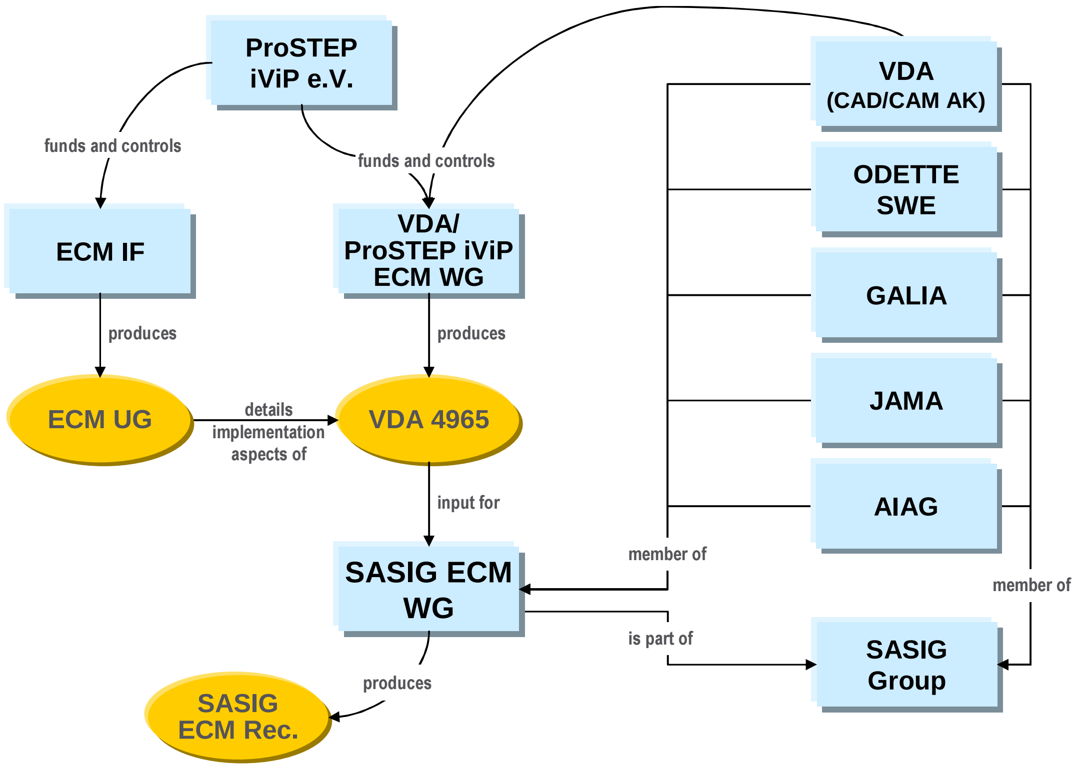

Figure 1: Collaborative Evolution of the SASIG ECM Recommendation

2 IDEF0 – SHORT OVERVIEW

IDEF0 is a US Department of Defense (DoD) Standard for the definition of processes. It was developed on the basis of SADT (Structured Analysis and Design Technique) from DeMarco.

IDEF0 is a simple method for representing processes (see Figure 2). The main graphical element is a box representing a process / an activity. Arrows carry a dedicated semantics, depending on the side of the rectangle where they are attached.

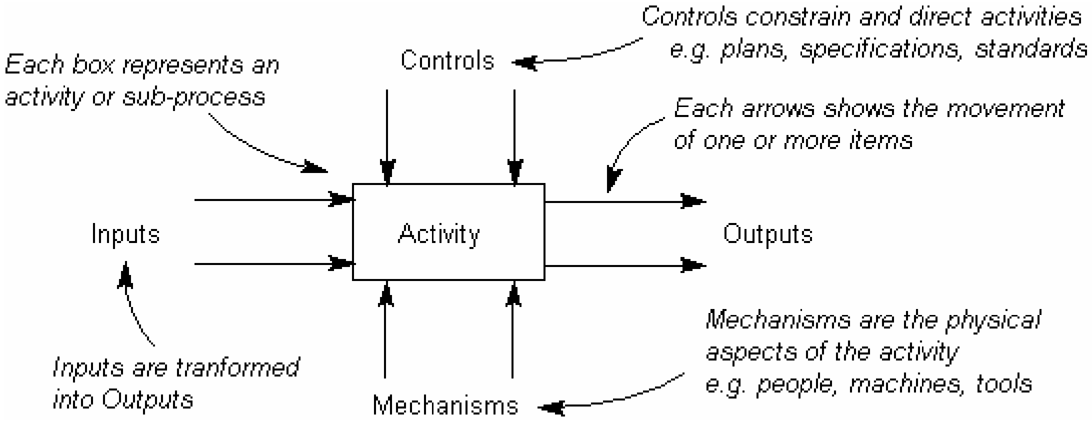

Figure 2: Main elements of the IDEF0 notation

- Inputs
  - are attached to the left side of the activity box
  - input data of the activity are typically transformed into output data by that activity
- Outputs
  - are attached to the right side of the activity box
  - are produced during the execution of the activity
- Controls
  - are attached to the top of the activity box
  - similar to input data
  - typically this kind of input controls the activity itself and are not changed by the activity
  - examples are: standards, templates, checklists
- Mechanisms
  - are attached to the bottom of the activity box
  - represent the resources that are used the execute the activity, e.g. persons, IT systems

Note: Input, Control, Output, and Mechanism are often referred to as ICOM

3 SASIG ECM REFERENCE PROCESS: SYNOPSIS

This chapter provides a short introduction into the SASIG ECM Reference Process, defines the over-all scope of this process and describes the dependencies between it's sub-phases thus providing an overall picture of the SASIG ECM Reference Process.

The SASIG ECM Reference Process comprises of the following five phases (Figure 3):

- Identification of Potential for Change
- Development of Alternative Solutions
- Specification of and Decision for Change
- Engineering Implementation of Change
- Manufacturing Implementation of Change

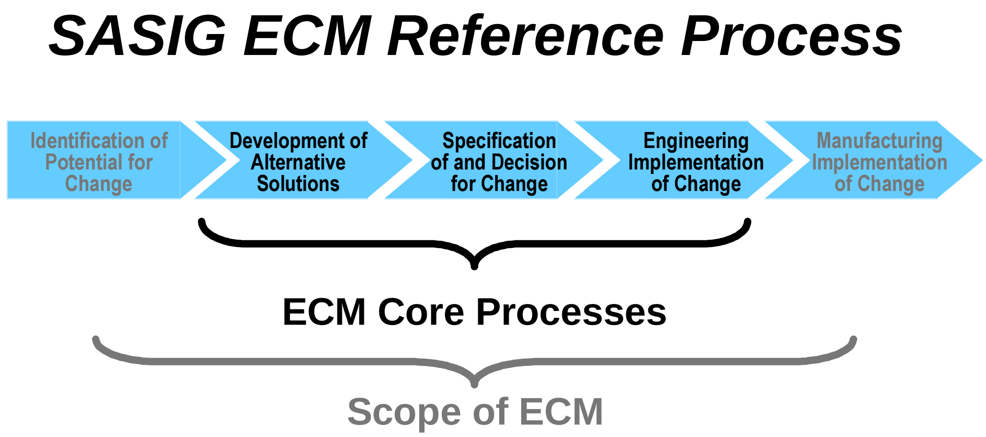

Figure 3: Phases of the SASIG ECM Reference Process

The processes "Development of Alternative Solutions", "Specification of and Decision for Change", and "Engineering Implementation of Change" are considered to form the ECM core processes, whereas the processes "Identification of Potential for Change", and "Manufacturing Implementation of Change" are considered to be in the scope of ECM, but belong to the Issue Management Process and the Production Process and are therefore a kind of interface to these two process (see Figure 4).

Note: the purpose of the SASIG Recommendation is to describe the cross-company ECM process. Nevertheless it may also be used for defining, optimizing, completing, etc. company internal ECM processes or might be used for supporting the company internal ECM Process.

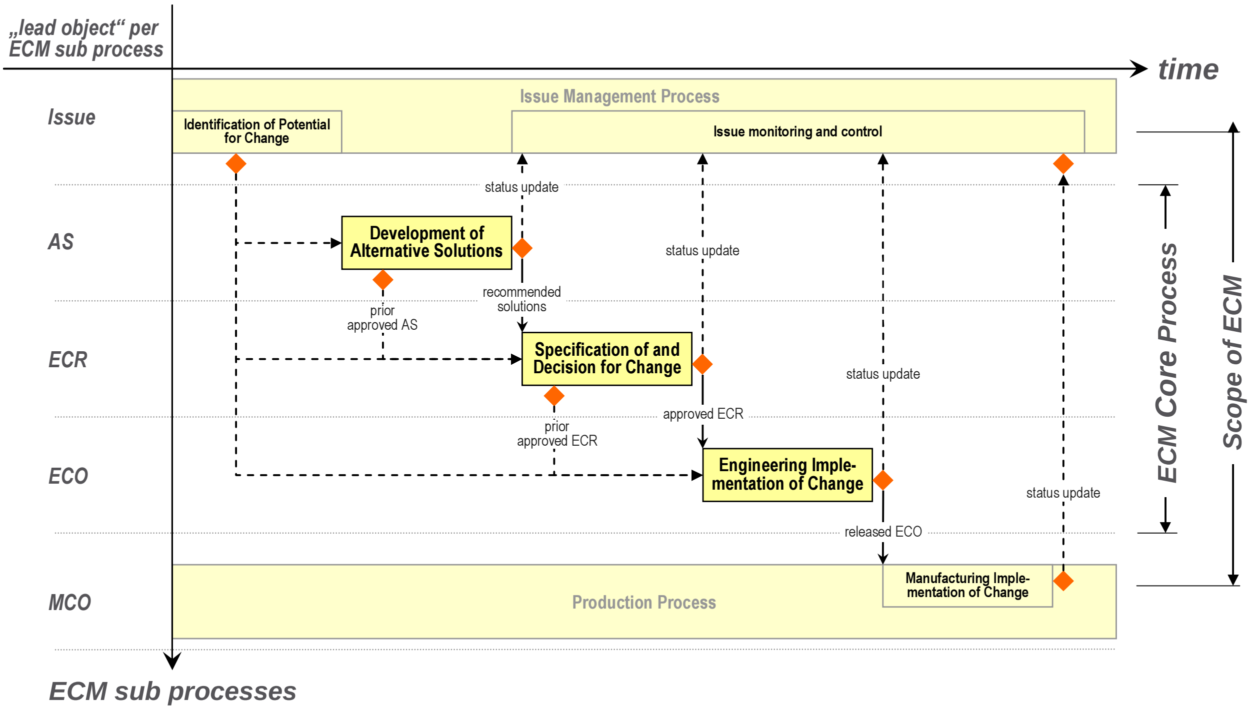

Figure 4: Simplified overall picture of the dependencies of the phases of the SASIG ECM Reference Process

Note: No restriction regarding the execution order of the illustrated processes is implied in Figure 4 above, i.e. the illustrated processes might be executed in sequence, in parallel or concurrently.

If the issue is considered to be solved by an Engineering Change, the decision made at process “Identification of Potential for Change” can trigger three potential processes: “Development of Alternative Solutions”, “Specification of and Decision for Change”, or “Engineering Implementation of Change”. Each of these core processes may report back status information to the Issues Management Process.

4 IDEF0 REPRESENTATION OF THE SASIG ECM REFERENCE PROCESS

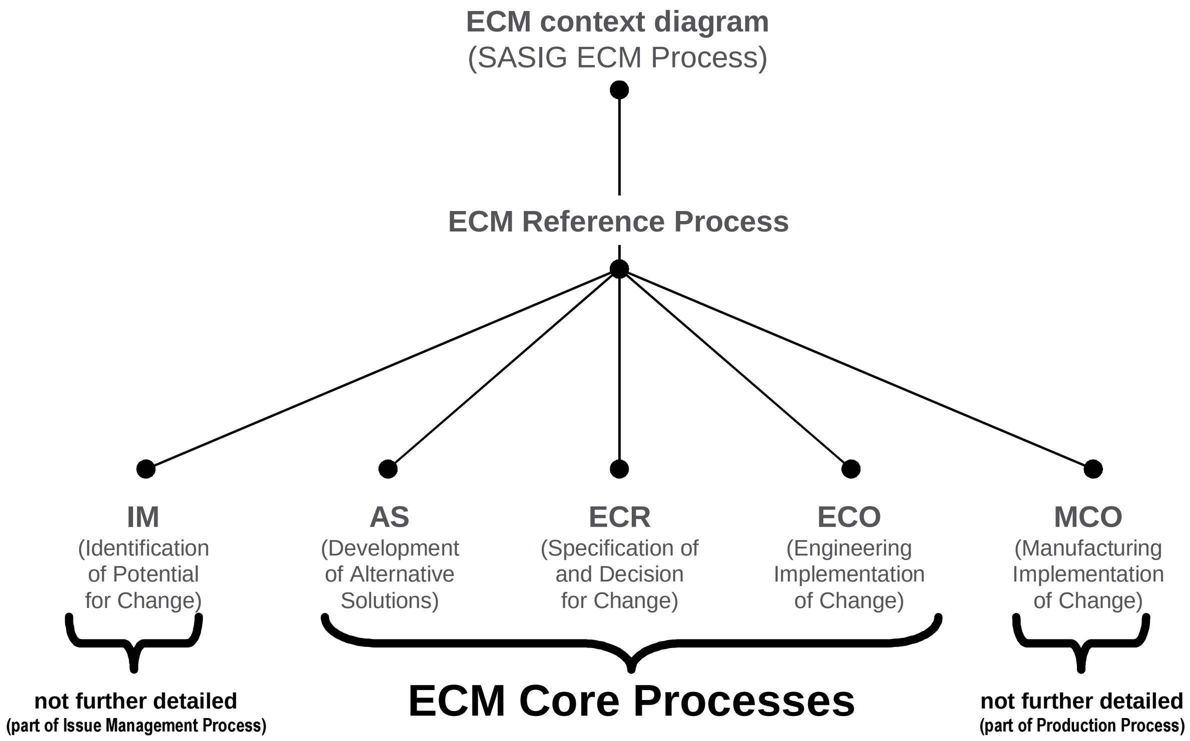

Figure 5: Structure of the nodes of the IDEF0 diagrams of the SASIG ECM Reference Process

In the subsequent sections the diagrams depicted in Figure 5 are further detailed for the following nodes:

- ECM context diagram (level 0)
- ECM Reference Process (level 1)
- Development of Alternative Solutions (level 2)
- Specification of and Decision for Change (level 2)
- Engineering Implementation of Change (level 2)

Note: Because of using the IDEF0 Notation, the ECM sub-processes “Identification of Potential for Change”, “Development of Alternative Solutions”, “Specification of and Decision for Change”, “Engineering Implementation of Change”, and “Manufacturing Implementation of Change” in the subsequent chapters of this document are called: “identify Potential for Change”, “develop Alternative Solutions”, “specify and decide on Change”, “implement the change in Engineering” , and “implement the change in Manufacturing”.

4.1 SASIG ECM Reference Process – Context Diagram (IDEF0 Level 0)

The IDEF0 context diagram of the SASIG ECM Reference Process is shown in Figure 6. The primary activities within Engineering Change Management comprise of:

- collecting ideas or a need for product changes,

- defining the necessary actions to be taken,
- elaborating one or more possible solutions,
- specifying and evaluating them with respect to technical and cost aspects and
- implementing the approved and authorized change with respect to engineering and manufacturing.

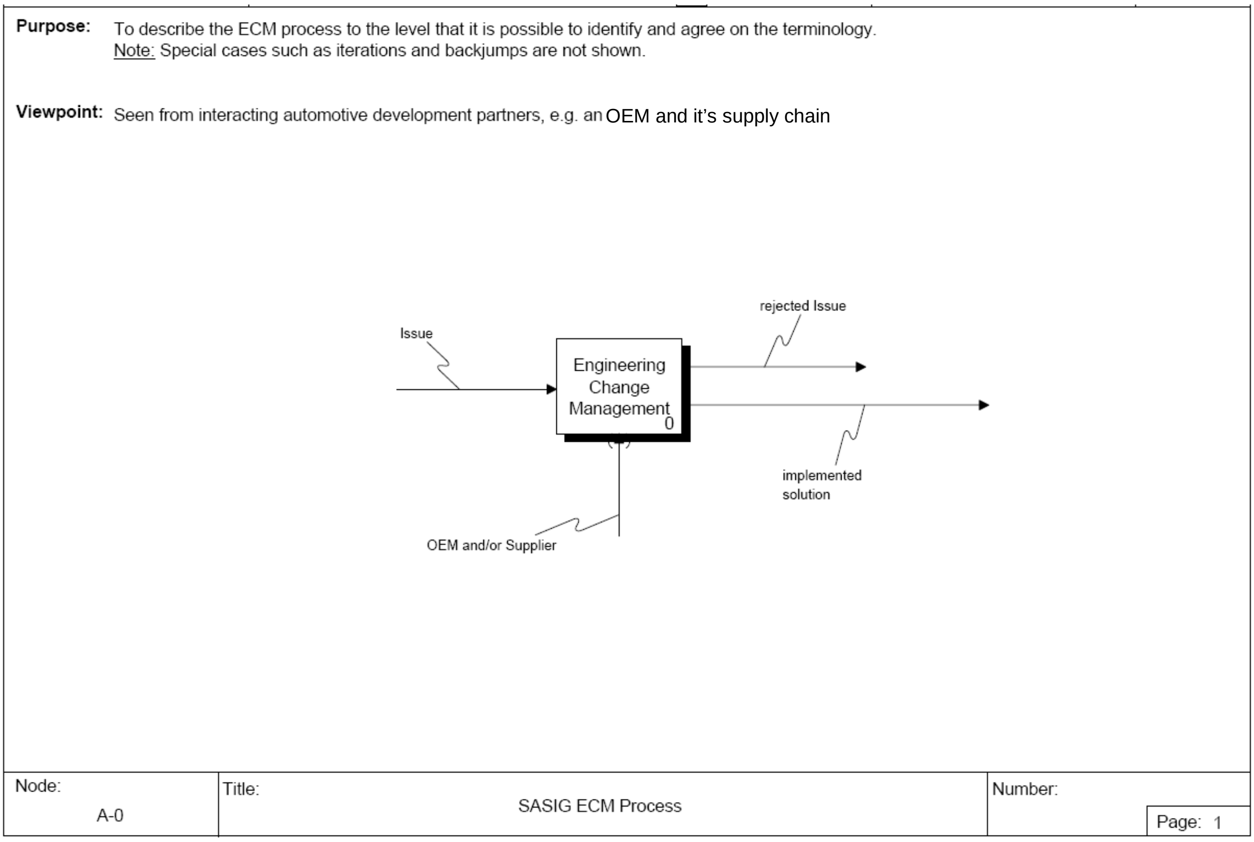

Figure 6: IDEF0 representation of the context diagram of the SASIG ECM Reference Process

In the following subsections the definitions of the activity shown in Figure 6 as well as the input, output, control and mechanism (ICOM) of these activities are defined.

4.1.1 Activity represented within the context diagram of the SASIG ECM Reference Process

The following activities are part of the SASIG ECM Reference Process:

- Engineering Change Management

4.1.1.1 Engineering Change Management

- the coordinated management and uniform tracking of engineering changes of a product, starting with the identification of potential for change and ending with the manufacturing implementation of change

4.1.2 ICOM's represented within the context diagram of the SASIG ECM Reference Process

The following ICOM are part of the context diagram of the "SASIG ECM Reference Process":

- Issue
- rejected Issue
- implemented Solution
- OEM and/or Supplier

4.1.2.1 Issue

- product related concern/deficiency identified by a stakeholder(s) that might result in a change of the product

4.1.2.2 Rejected Issue

- "Issue" that is denied by the product owner

4.1.2.3 Implemented Solution

- result of the engineering change actions taken to resolve "accepted issue(s) as an engineering change", implemented in the "implement the change in Manufacturing" process at a given specified date

4.1.2.4 OEM and/or Supplier

- an OEM is an automotive Original Equipment Manufacturer, e.g. BMW, Daimler, Mazda, PSA, Renault, Scania, Volvo Group, VW/Audi.
- a supplier is a provider of products/services to an OEM and/or another supplier. The suppliers are classified as prime contractors, system suppliers, module suppliers, component suppliers, part suppliers or engineering service provider.

4.2 Activity: Engineering Change Management (IDEF0 Level 1)

The IDEF0 breakdown of the activity "Engineering Change Management" is shown in Figure 7. The following assumptions apply:

- The sub-activity "identify the Potential for Change" is considered to be part of an "Issue Management Process". This process is considered to be out of scope and is neither shown in the following diagrams nor detailed in this document.
- Each of the sub-activities shown in the diagram may report back its status to that Issue Management Process. This is also not shown in the diagram.
- There might be multiple outputs of the activity "identify the Potential for Change", except when the issue is rejected.
- The output "accepted issues for other solution activities" does not belong to the SASIG ECM Reference Process.
- The sub-activity "implement the Change in Manufacturing" is considered to be part of the "Production Process". This process is considered to be out of scope and is neither shown in the following diagrams nor detailed in this document.

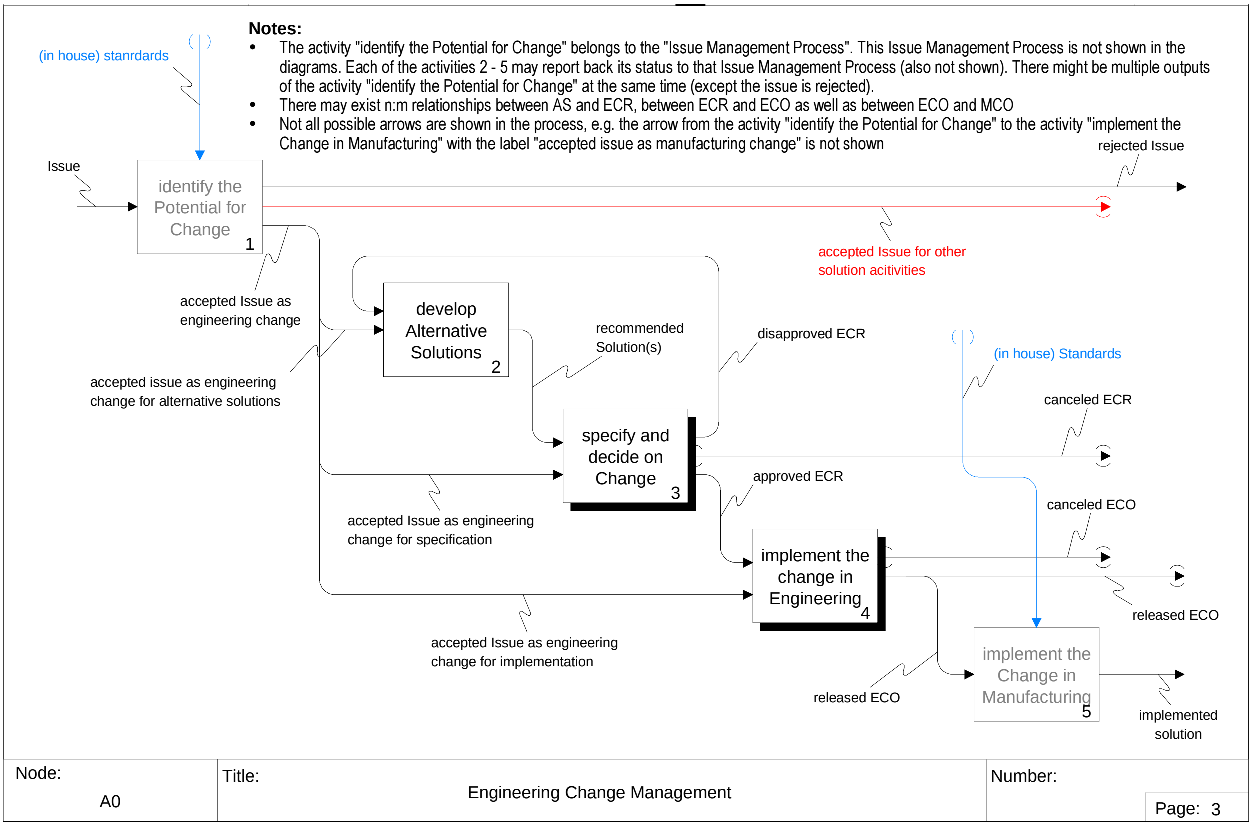

Figure 7: IDEF0 breakdown of the "Engineering Change Management" activity

In the following subsections the definitions of the sub-activities shown in Figure 7 as well as the input, output, control and mechanism (ICOM) of these sub-activities are defined.

4.2.1 Sub-activities represented within the activity "Engineering Change Management"

The following sub-activities are part of the activity "Engineering Change Management":

- identify the Potential for Change
- develop Alternative Solutions
- specify and decide of Change
- implement the change in Engineering
- implement the change in Manufacturing

4.2.1.1 Identify the Potential for Change

- a set of activities triggered by an incoming issue that results in a "rejected issue" or an "accepted" issue including identified actions necessary to resolve the issue
  - if accepted, the actions to resolve the accepted issue will be identified and triggered
  - engineering change is one possible action
- Notes
  - Within this set of activities the issue is analyzed and decided if it is accepted or rejected. If the issue is accepted, the actions necessary to resolve the issue are identified and triggered.

- If the actions identified result in an engineering change(s), the SASIG ECM Reference Process is triggered
- Otherwise, other resolution activities are triggered. These activities are not in scope, because the WG assumes that there are in house standards / processes in place. These internal standards/processes can be proprietary and/or open

- If the identified action is an engineering change(s), it needs to be decided which of the following processes has to be entered
  - Development of Alternative Solutions
  - Specification of and Decision for Change
  - Engineering Implementation of Change

4.2.1.2 Develop Alternative Solutions

- a set of activities triggered by either the process “identify the Potential for Change” or by the process “specify and decide on Change” that results in one or more “recommended Solution(s)”
- Notes
  - Within this set of activities the “accepted issue as engineering change for alternative solutions” is further analyzed, potential solutions are developed and documented, and evaluated.
  - Finally one or more “recommended Solutions(s)” are selected and the “specify and decide on Change” process is triggered.
  - The following scenarios are possible
    - Scenario 1: each of the recommended solutions is covered in one ECR (example: same issue, but different suppliers)
    - Scenario 2: several recommended solutions are covered by one ECR (example: same issue, but different technical solutions on part level)

4.2.1.3 Specify and Decide on Change

- a set of activities triggered by either the “identify the Potential for Change” or by the “develop Alternative Solutions” process that results in an “approved”, “disapproved ECR”, or a “canceled ECR”
- Notes
  - this set of activities can be canceled/terminated at any time. The cancellation may require further actions that might be part of the overall Issue Management Process.
  - an approved ECR may result in one or more ECO(s) and several ECRs may result in one ECO (i.e., a m:n or many to many relationship between ECRs and ECOs is possible)

4.2.1.4 Implement the Change in Engineering

- a set of activities triggered by either the “identify the Potential for Change” or by the “specify and decide on Change” process that results in a “released ECO” or “canceled ECO”
- Notes

    - This set of activities can be canceled/terminated at any time. The cancellation may require further actions, which may be a part of the overall Issue Management Process.
    - Where an ECO impacts manufacturing (e.g. material or shape changes), the "released ECO" will trigger one or more MCO(s).
    - A "released ECO" == implemented solution within the product definition information including the BOM.
    - A released ECO may result in one or more MCO(s), e.g. one per plant or product, and several ECOs may result in one MCO (m:n relationship).

4.2.1.5 Implement the Change in Manufacturing

- a set of activities triggered by the process "implement the change in Engineering" that results in an "implemented solution"
- Notes
    - this set of activities is not in focus. It is assumed there are in-house standards / processes in place
    - these in-house standards/processes can be proprietary or open
    - "implemented solution" == a released MCO has reached the effective date
    - the "implement the change in Manufacturing" process may create Issues that need to be managed by the ECM process

4.2.2 ICOM's represented within the activity "Engineering Change Management"

The following ICOM are part of the activity "Engineering Change Management":

- accepted Issue for other solution activities
- accepted Issue as engineering change
- accepted Issue as engineering change for alternative solutions
- accepted Issue as engineering change for specification
- accepted Issue as engineering change for implementation
- recommended Solution(s)
- approved ECR
- disapproved ECR
- released ECO
- canceled ECR
- canceled ECO

4.2.2.1 Accepted Issue for other solution activities

- an "Issue" that is agreed by the product owner and requires solution activities that are not in the scope of engineering change
- Note:
    - examples of such activities include training activities, process changes, and customer information

4.2.2.2 Accepted Issue as engineering change

- an "Issue" that is agreed by the product owner and requires engineering change solution activities

4.2.2.3 Accepted Issue as engineering change for alternative solutions

- an "accepted Issue as engineering change" that triggers the "Development of alternative solution"

4.2.2.4 Accepted Issue as engineering change for specification

- an "accepted Issue as engineering change" that bypasses "develop Alternative Solutions" and directly triggers "Specification of and decision for change"

4.2.2.5 Accepted Issue as engineering change for implementation

- an "accepted Issue as engineering change" that bypasses "develop Alternative Solutions" and bypasses "Specification of and decision for change" and directly triggers "implement the change in Engineering"

4.2.2.6 Recommended Solution(s)

- approved change idea(s) for the "accepted issue as engineering change" based on first evaluation impact on cost, time, quality and affected parts
- Notes:
  - at this stage the evaluation of possible solutions for the "accepted issue" is still under investigation.
  - the "recommended Solution(s)" will be further detailed. This will be done in the "Specification of an Decision for change" process

4.2.2.7 Approved ECR

- detailed, evaluated and by the product owner / decision making team approved specification of the change

4.2.2.8 Disapproved ECR

- detailed, evaluated and not approved specification of the change
- Notes:
  - it will trigger (again) the "develop Alternative Solutions" activities in order to generate alternate "recommended Solution(s)"
  - an endless loop will not occur, due to defined decision and approval processes in place

4.2.2.9 Released ECO

- planned, executed, approved, authorized and completed change to the product definition data, including the update of the Bill of Material (where necessary)
- Notes
  - Assumption: manufacturing is part of the decision team for approval of the change at the end of "Specification of and Decision for Change" process, i.e. they know about the upcoming change in advance.

   - if the released ECO impacts manufacturing, the “implement the change in Manufacturing” process will be triggered
   - in this scenario the released ECO is input for MCO activities, which by itself are not part of the ECM Core Processes and therefore not further detailed
   - an example of a released ECO without impact on manufacturing processes, is an editorial change of the previously released drawing which may lead to a new change level in the Bill of Material
   - therefore, depending on the change, the updated BOM can be the “BOM as designed”, the “Prototype BOM”, the “BOM as planned”, the “BOM as built” and the “after sales BOM”

4.2.2.10 Cancelled ECR

- is an engineering change request that is withdrawn for any reason at any stage
- Notes
   - if an ECR is canceled, the associated accepted issue is not solved by this ECR (it might be addressed by another ECR or by another activity)
   - Assumption: the content of a canceled ECR will be frozen and archived, e.g. for documentation purpose

4.2.2.11 Cancelled ECO

- is an engineering change order that is withdrawn for any reason at any stage
- Notes
   - if an ECO is canceled, the associated accepted issue is not solved by this ECO (it might be addressed by another ECO or by another activity)
   - Assumption: the content of a canceled ECO will be frozen and archived, e.g. for documentation purpose

4.3 Activity: develop Alternative Solutions (IDEF0 Level 2)

Although this activity is part of the ECM core process, it is not further detailed. Primary reasons are:

- this activity is considered to be done in an informal way
- there seems to be almost no communication with partners during this activity

4.4 Activity: specify and decide on Change (IDEF0 Level 2)

The IDEF0 breakdown of the activity “specify and decide on Change” is shown in Figure 8.

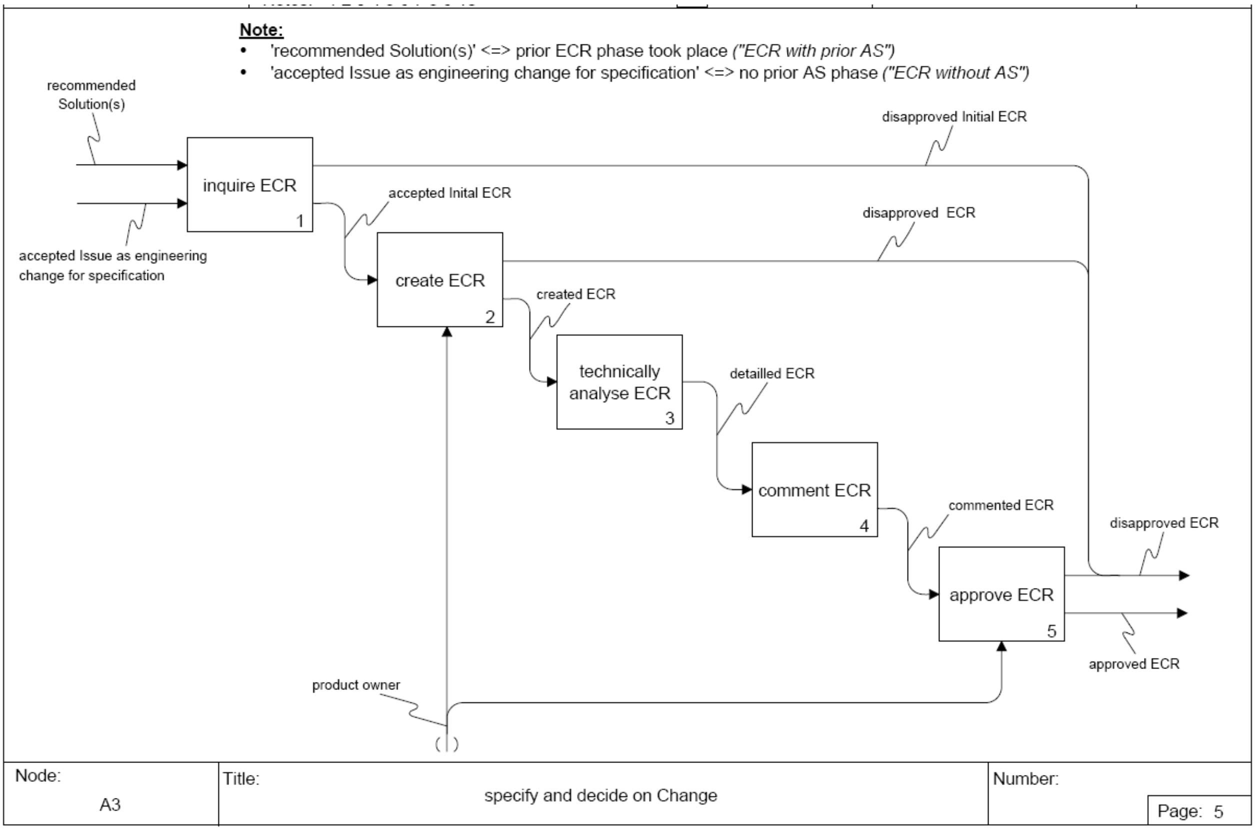

Figure 8: IDEF0 breakdown of the activity "specify and decide on change"

In the following subsections the definitions of the sub-activities shown in Figure 8 as well as the input, output, control and mechanism (ICOM) of these activities are defined.

4.4.1 Sub-activities represented within the activity "specify and decide on Change"

The following sub-activities are part of the activity "specify and decide on Change":

- inquire ECR
- create ECR
- technically analyze ECR
- comment ECR
- approve ECR

4.4.1.1 Inquire ECR

- Initial phase where incoming requests (= "accepted Issue as engineering change for specification" or "recommended Solution(s)") for ECRs are recorded, clarified, classified and or filtered for acceptance or rejection. In case of acceptance, a lead is assigned and the "create ECR" phase is triggered.
- Notes
  - in this phase, the proposal for an ECR is at least recorded in rough outline and classified, and on this basis the decision is taken as to whether the proposal is to be further pursued as an ECR in subsequent phases.

  - This is designed to exclude proposals for ECRs which have in the past already proven to offer no potential benefit
  - on the basis of the rough description and the assignment of the ECR, the member of staff and or committee is named who will be responsible for creating the ECR and describing it in more detail in the subsequent activity

4.4.1.2 Create ECR

- a phase where accepted initial ECR is assigned a unique ID, classified, described and planned with respect to resources, responsibilities and timing. Within this phase, initial technical analysis steps and an acceptance step can also be defined.
- Notes
  - the ECR description may involve ECR data such as the problem description, the scope of the change (affected series, products, projects, etc.), the proposed solution for the change, the consequences when not performing the change, the distribution list of involved persons etc. being supplemented and described in more detail.

4.4.1.3 Technically analyze ECR

- in this phase impact studies are done with respect to affected parts, the technical aspects of the ECR are evaluated, weight and cost evaluations performed and criteria established for further advancement to the “comment ECR” phase.
- Notes
  - Typically, the analysis is carried out by developers, each of whom perform an analysis step for the part of the ECR for which he/she is responsible for
  - In doing this, the developers identify the parts or documents which are affected and give an expert opinion with respect to feasibility, implementation and any consequences of the change
  - In addition, they can provide estimates with respect to costs, schedule, any impact on weight, etc. in consequence of the changes to the affected modules, parts or documents
  - Estimates with respect to the cost of the actual ECR, i.e. the costs of evaluating the change and a schedule and/or individual deadlines for the ECR can also be made
  - Assumption: technical analysis may contain design study efforts on coordinator as well as on participant side. Costs resulting from these efforts are contracted on a time and material basis including try out parts between customer engineering and supplier. The impact on part and tooling cost is formally analyzed in the “comment ECR” phase

4.4.1.4 Comment ECR

- in this phase the ECR is further analyzed from the perspective of prototyping, certification, procurement, logistics, production planning, quality assurance, etc. in terms of costs, risks, attractiveness, technical feasibility, and timing. The final result of this phase is an ECR ready for final approval
- Notes
  - Costs: sum of all cost impacts of the anticipated change, except the costs for evaluating the change. Examples for cost include engineering costs, product costs, tooling costs, process costs, and others.

4.4.1.5 Approve ECR

- in this phase the final decision is made to approve or disapprove the ECR
- Notes
  - if the ECR is disapproved, the “develop Alternative Solutions” process will be triggered
  - another possibility is to cancel an ECR. In this case the ECR process is terminated for that specific ECR
  - the approved ECR may result in one or more ECOs
  - the approval is done by a decision team which is led by the product owner

4.4.2 ICOM’s represented within the activity “specify and decide on Change”

The following ICOM are part of the activity “specify and decide on Change”:

- accepted initial ECR
- disapproved initial ECR
- created ECR
- detailed ECR
- commented ECR
- product owner

4.4.2.1 Accepted initial ECR

- an initial ECR that is agreed to by the product owner

4.4.2.2 Disapproved initial ECR

- an initial ECR that is not approved to by the product owner

4.4.2.3 Created ECR

- an ECR that is agreed to by the product owner for further analysis

4.4.2.4 Detailed ECR

- an ECR that is detailed from an technical perspective

4.4.2.5 Commented ECR

- an ECR that is reviewed and commented and ready for submission for final approval

4.4.2.6 Product owner

- the entity that possesses the product
- Notes
  - examples for products include cars, trucks, antenna systems, and engine cooling systems
  - in the SASIG ECM Recommendation, the product owner is called an “Coordinator”. Entities involved in the processing of the engineering change are called “Participants”

4.5 Activity: implement the change in Engineering (IDEF0 Level 2)

The IDEF0 breakdown of the activity "implement the change in Engineering" is shown in Figure 9.

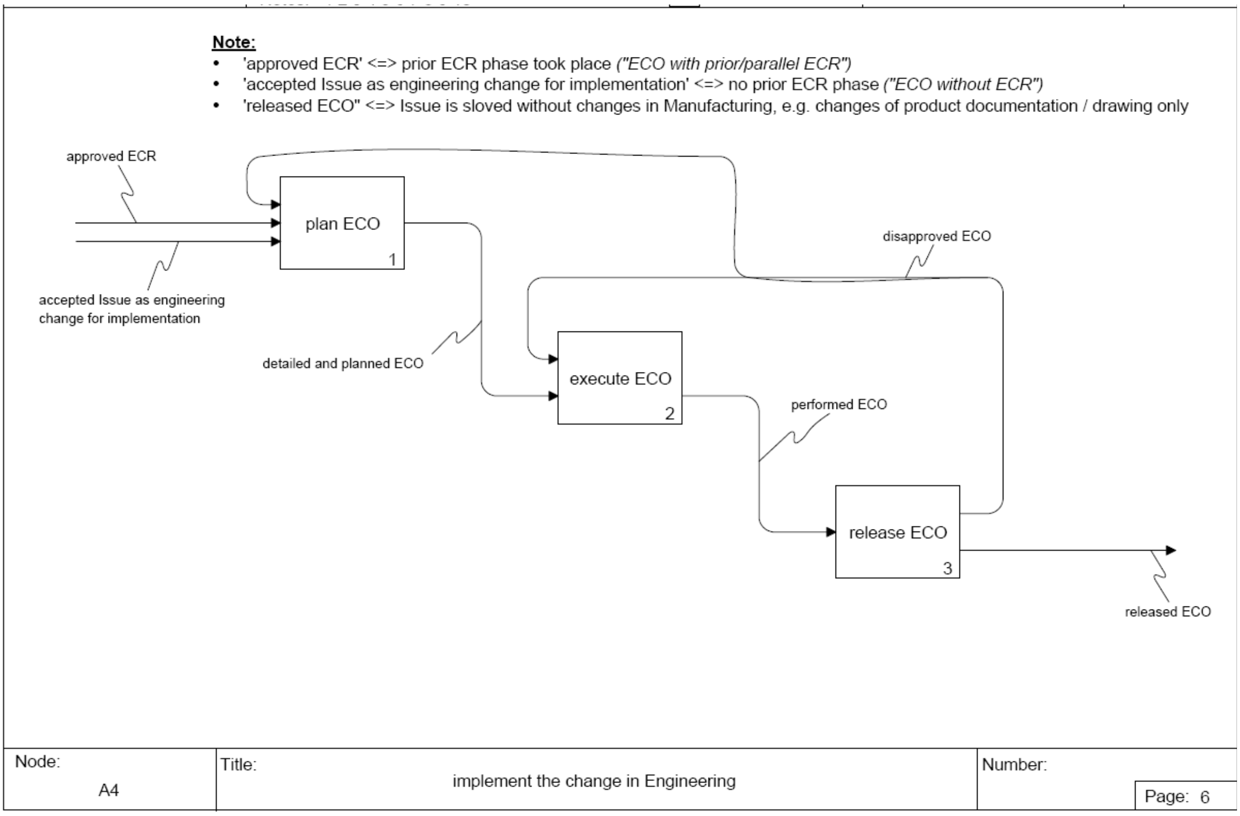

Figure 9: IDEF0 breakdown of the activity "implement the change in Engineering"

In the following subsections the definitions of the sub-activities shown in Figure 9 as well as the input, output, control and mechanism (ICOM) of these activities are defined.

4.5.1 Sub-activities represented within the activity "implement the change in Engineering"

The following activities are part of the activity "implement the change in Engineering":

- plan ECO
- execute ECO
- release ECO

4.5.1.1 Plan ECO

- a set of activities triggered by an "approved ECR", "accepted issue as engineering change for implementation" or by a "disapproved ECO" that results in a "detailed and planed ECO"
- Notes
  - these set of activities include the assignment of a responsible entity, the specification of the scope of the ECO, the affected product data, the needed development tasks for design and validation as well as the schedule and planned performers
  - planning is also done with respect to other ongoing and upcoming changes

- at this point in time, new parts are described by an unique ID only
- if an ECR is approved before, and the planning is done during the ”specify an decide on change” process, this goal may already be given at the beginning of the ”implement the change in Engineering” process
- an ECO can be based on one or more ECR(s)
- in general, m:n relationships between ECR(s) and ECO(s) are possible

4.5.1.2 Execute ECO

- a set of activities triggered by an “detailed and planned ECO” or by an “disapproved ECO” that results in a “performed ECO”
- Notes
  - among the set of activities, are activities for change and validation of product definition data
  - product definition data includes 3D geometry, drawings, etc.
  - if engineering considers the change to be performed, the release of the “performed ECO” as well as the release of the product data can be triggered
  - the ECO status is updated and all results (e.g. drawings) are linked to the ECO

4.5.1.3 Release ECO

- a set of activities triggered by a “performed ECO” that results in a “released ECO” or a “disapproved ECO”
- Notes
  - for release, at product documentation the technical and formal completeness of the ECO and the approved changes of the affected objects are confirmed and ensured
  - if the ECO is disapproved, a rollback to “plan ECO” or to “execute ECO” is done
  - if the ECO is approved, the release is triggered and all the approved changes become active
  - example: an approved change may include a BOM change
  - affected entities / subsequent processes should be notified about the released ECO during the release activity

4.5.2 ICOM’s represented within the activity “implement the change in Engineering”

The following ICOM are part of the activity “implement the change in Engineering”:

- detailed and planed ECO
- performed ECO
- disapproved ECO

4.5.2.1 Detailed and planed ECO

- ECO containing all necessary information to be able to execute the change

4.5.2.2 Performed ECO

- ECO containing the results of executing the change ready for formal checking and release
- Note
  - the content of an “performed ECO” shall not be modified

4.5.2.3 Disapproved ECO

- ECO which is detailed, evaluated, executed but not approved
- Notes:
  - it will trigger (again) the “plan ECO” activities or the “execute ECO” activities in order to modify the “performed ECO”
  - endless loops will not occur, due to internal defined processes in place

MAINTENANCE FORM

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