CHANGE MANAGEMENT PROCEDURE

Document number SKA-TEL.SE.CONF-SKO-PR-001
Revision 1
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Date 2013-03-10
Status.....Released

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Released by:				
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DOCUMENT HISTORY

Revision	Date Of Issue	Engineering Change Number	Comments
A	2013-03-01	-	First draft release for internal review
B	2013-02-20	-	Changes following review
C	2013-02-25	-	Implementation added (section 6.6)
D	2013-02-26	-	Figure 2 added
E	2013-02-28	-	Editorial
1	2013-03-10	-	Released for RfP

DOCUMENT SOFTWARE

	Package	Version	Filename
Wordprocessor	MsWord	Word 2007	SKA-TEL.SE.CONF-SKO-PR-001-E_Change_Proc.docx
Block diagrams			
Other			

ORGANISATION DETAILS

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LIST OF ABBREVIATIONS

AD .....Applicable Document
AN .....Another
CCB.....Configuration Control Board
CI.....Configuration Item
CM.....Configuration Manager
CPM .....Consortium Project Manager
CRB.....Change Review Board
CSE .....Consortium System Engineer
ECP .....Engineering Change Proposal
E-ELT .....European Extremely Large Telescope
EPM.....Element Project Manager
ESE .....Element System Engineer
EX.....Example
RD .....Reference Document
SEMP .....System Engineering Management Plan
SKA .....Square Kilometre Array
TBC .....To be confirmed
TBD .....To be determined
TBR .....To be reviewed
TBS .....To be supplied
WBS .....Work Breakdown Structure
WP.....Work Package

1 Introduction

1.1 Purpose of the document

This document details the process of handling Engineering Change Proposals (ECPs) from their creation to final decision.

This procedure is the implementation of the Change Management concepts defined in [RD1] and it is mandatory for every ECP generated for the SKA project either from SKA internally or by a Consortium.

Change Requests generated within Contracts and that have no impact on any SKA Configuration Item (i.e., any CI that has been subject of any Consortium-SKA activity) are handled according to the Consortium's procedure, defined in the Consortium specific Configuration Control Plan. This procedure can be used as guideline for such localized procedures.

1.2 Scope of the document

The handling of Requests for Waiver, Requests for Deviation and Contract Amendments are not in the scope of this procedure.

The applicability of this procedure to ECPs against high level documents such as the Design Reference Mission [RD3] and the Concept of Operations [RD4] is TBC.

This document is based upon [RD2].

2 References

2.1 Applicable documents

The following documents are applicable to the extent stated herein. In the event of conflict between the contents of the applicable documents and this document, **the applicable documents** shall take precedence.

[AD1] SKA Document Management Plan, SKA-TEL.MGT.DMT-SKO-MP-001
[AD2] Work Breakdown Structure

2.2 Reference documents

The following documents are referenced in this document. In the event of conflict between the contents of the referenced documents and this document, **this document** shall take precedence.

[RD1] System Engineering Management Plan
[RD2] ESO E-ELT Change Request Procedure E-PRO-SKA-156-0119 Issue 2 22.10.2008
[RD3] The Square Kilometre Array Design Reference Mission: SKA Phase 1, SCI-020.010.020-DRM-002
[RD4] Concept of Operations for the SKA Observatory, SKA.TEL.SE.OPS-SKO-COO-001-0-A

2.3 Glossary

Term	Meaning in this document
Configuration Item	A product or a documentation artefact created or used by the SKA Project that is under configuration management
Initial change	A change request made in isolation and not made as a consequence of a change already proposed but not yet approved.
Consequential change	A change request made for consideration as it is necessitated by a prior proposed request.

Table 1 : Glossary

3 Engineering Change Proposal (ECP)

3.1 What is an ECP?

An ECP expresses the need for a permanent change of one or more Configuration Items. The rationale for a change could be one or more of the following:

- Functional/Performance improvement or correction
- Change of interfaces
- New requirements
- A change in schedule and/or costs above a certain threshold (TBD)

The ECP process is the formal way to evaluate and to assess possible impacts that a proposed change will have on:

- Schedule,
- Performance,
- Full lifecycle cost,
- Interfaces to other Elements or the external world.

According to their impact, ECPs are classified as either Minor, Major or System Level, based on an evaluation by the SKA Chief System Engineer, SKA Architect & SKA Project Manager and following guidelines provided by the SKA Configuration Control Board (see below).

All ECPs are considered, initially, to be associated with an Element, even if the proposed CI change is at System level. This ensures that the appropriate technical expertise is involved at the outset.

Minor ECPs are handled with a simplified process.

The final and only authority to decide on the acceptance of a change is the SKA Configuration Control Board. ECPs that are delayed by the action or inaction of the proposer without justified reasons are deemed to be closed/rejected.

3.2 When is an ECP Minor?

An ECP is classified as "Minor" if at system level the impact is within **all** the following limits:

- Total cost impact less than 10,000 Euro including costs associated with schedule
- Schedule deviation of less than 1 month of delay at Element level
- Performance deviation at Telescope level is negligible (typically within 2% with respect to performance requirements; at the discretion of the SKA Architect).
- All necessary (initially proposed & consequential) changes are confined to one Element
- No interfaces external to the Element are affected

This definition is subject to variation by CCB action.

3.3 When is an ECP Major?

An ECP is classified as "Major" if it is outside the boundaries set for a Minor one AND all changes are confined to one Element OR if, despite falling within the Minor limits, the SKA Chief System

Engineer, SKA Architect and SKA Project Manager vote for it to be referred to a Change Review Board.

This definition is subject to variation by CCB action.

3.4 When is an ECP 'System Level'?

An ECP is classified as 'System Level' when the proposed changes affect more than one Element.

This definition is subject to variation by CCB action.

3.5 Identifying an ECP

Each ECP will be identified by a unique document number generated by the SKA Office according to the SKA document numbering scheme [AD1].

The process involves several steps, whose execution is the responsibility of various roles within the SKA Office orchestrated by the SKA Office Configuration Manager, each providing a separate contribution (form). Each form uses the unique ECP document number as root for the identification plus a suffix to identify the specific part.

At the end of the process, all parts are collected and consolidated into a single document, under the unique ECP document number.

4 The ECP process at glance

The ECP process described in this procedure is the means by which a proposed permanent change is:

- Fully motivated
- Fully and unambiguously described.
- Thoroughly analysed to assess technical feasibility and managerial suitability, as well as to have the best estimate on both positive and negative expected impacts.
- Formally discussed to achieve a sound decision on whether to accept and implement the proposed change in the project.

All changes to configuration items shall be handled via the ECP process, but as not all changes may have the same level of impact, the procedure foresees a simplified path for Minor ECPs, being those the ones with a limited impact.

For urgent ECPs, a Fast Track process is given below (4.3).

Following sections provide the detailed definition of the roles, the activities, and the tools (forms) involved during the processing of an ECP. A map of the ECP process is shown below.

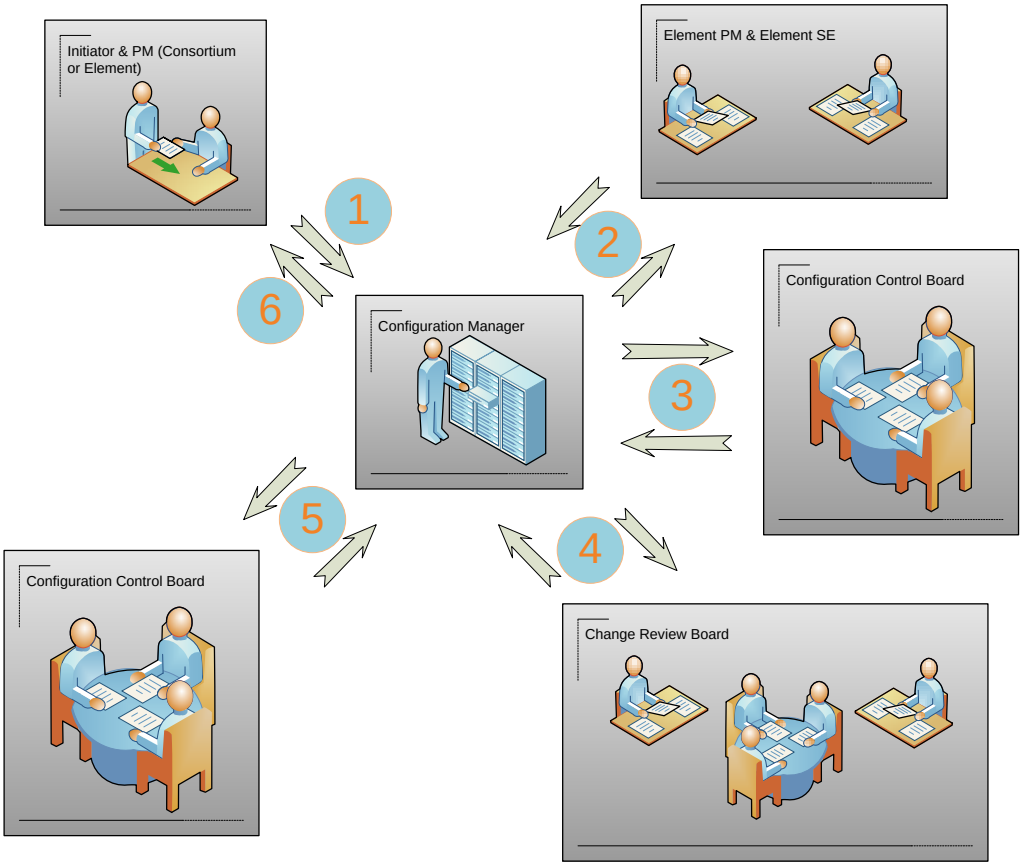

Figure 1: The normal ECP work flow**.**

Steps in the normal workflow:

1. Need for a permanent change identified, ECP definition and scope formalised by joint action between Consortium PM (if from a Consortium) or Element Project Manager (if from outside a Consortium) and the initiator. A complete and procedurally satisfactory ECP is then submitted to the Configuration Manager. Any proposal for Fast Track processing is agreed.
2. First technical/managerial assessment, EPM recommendation for classification (System Level/Major/Minor), Fast Track status and follow up (Accept, Reject, ask for a CRB)
3. Based on EPM recommendation, CCB goes either for a final decision (System Level/Major/Minor, Accepted/Rejected) or to follow up with a detailed analysis. If a final decision is reached, step 4 and 5 are skipped.
4. The Change Review Board performs technical and managerial detailed analysis, providing final recommendation
5. Final decision of the CCB on CRB recommendation. (If CCB unsatisfied, return to CRB for further work, return to step 4).
6. Decision recorded by CM and transmitted to initiator for implementation. Implementation is then monitored until completion criteria are met, the Chairman of the CCB signs it off and the CM archives the whole record.

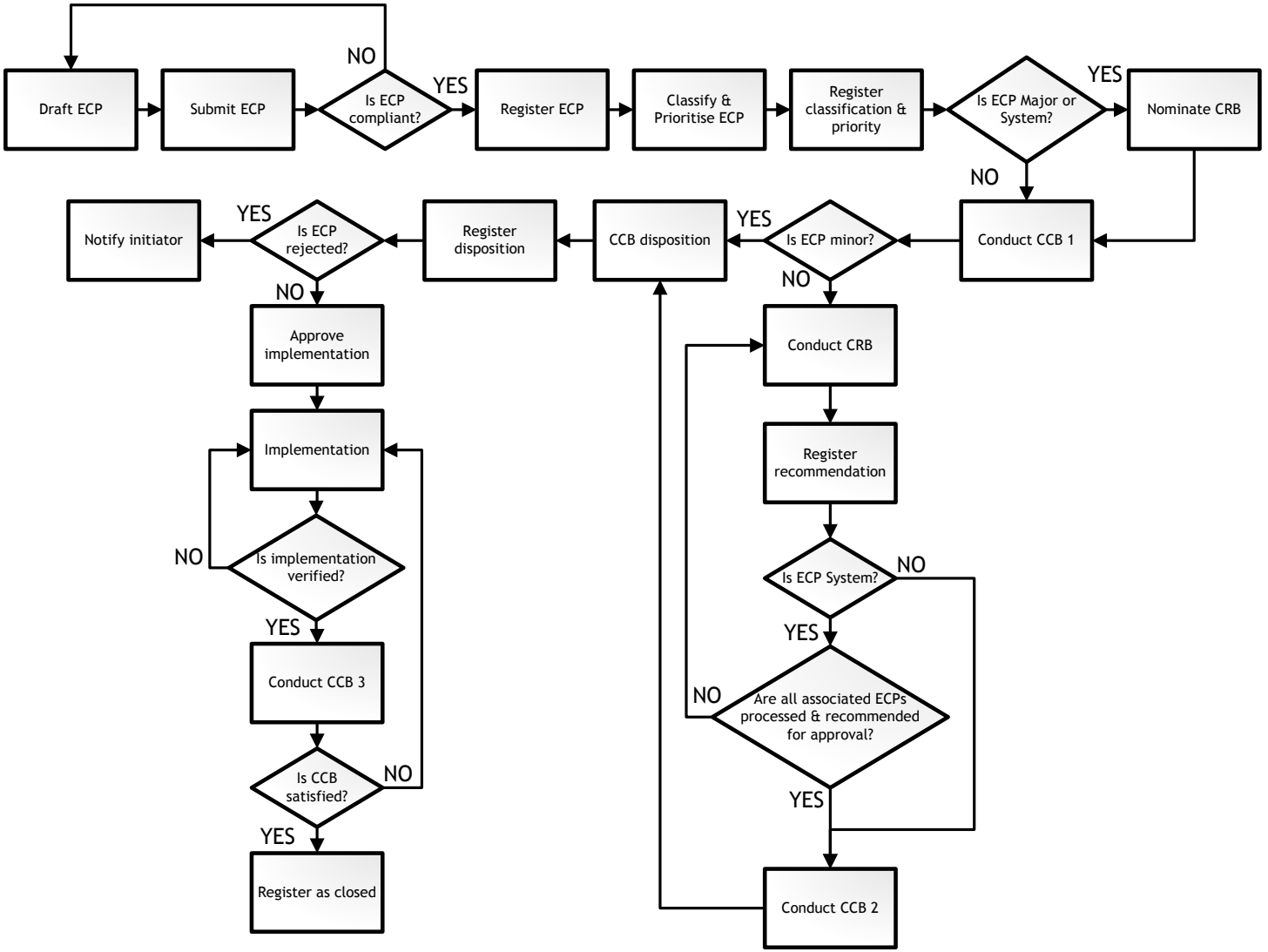

Figure 2: The ECP work flow diagram**.**

Figure 2 shows a flow diagram reflecting the sequences for Minor, Major and System level ECPs. 'CCB 1', 'CCB 2' and 'CCB 3' refer to meetings of the Configuration Control Board for the purposes of ratifying the initial assessment, ratifying the Change Review Board recommendations and closing out the ECP process following a completed implementation, respectively.

4.1 The simplified process for Minor ECPs

If the SE recommendation is endorsed by the CCB, steps 4 and 5 are skipped.

4.2 The enhanced process for System Level ECPs

System Level ECPs affect the cost, schedule, interfaces, performance, development, design or operations of more than one Element. This fact may be recognised at the outset, or may not emerge until analysis has been carried out. In both cases the consequential changes are entered into the change management process by the Element Project Manager and treated according to their classification. These consequential ECPs progress up to the approval stage and are held until all other associated ECPs have been similarly processed. The CCB will then approve or reject the initial ECP along with all the associated ECPs.

4.3 The Fast Track for urgent ECPs

In exceptionally urgent cases, the SKA Element Project Manager can provide rationale and ask for immediate submission of the ECP to CCB (fast track).

In this case and with reference to the previous page, step 2 is skipped and the ECP goes directly to the CCB (step 3). CCB can take a final decision or send back the ECP to the normal flow (step 2).

5 Roles

The ECP process involves the following roles:

- Configuration Manager (CM)
- Initiator
- Consortium Project Manager (CPM) possibly supported by the Consortium System Engineer (CSE)
- Element Project Manager (EPM)
- Element System Engineer (ESE)
- Configuration Control Board (CCB)
- Change Review Board (CRB)
- Implementer(s)
- Product Assurance (PA)

5.1 SKA Configuration Manager (CM)

The SKA Office Configuration Manager (CM) will oversee the formal execution of the ECP process.

The CM registers the ECP upon entry to the change management process and give the ECP its unique identifier, relating it to the affected Configuration Item through the associated work package. The work package is identified by the WP designator, according to the SKA Work Breakdown Structure **Error! Reference source not found.**[AD2]. For Consortia, the WP designator is provided.

The CM is the only interface for any of the role players during the ECP process execution, acting as a central point for collecting and distributing the relevant information.

The CM can reject the output of a phase on the basis of formal non-compliance with this procedure.

The CM keeps record of CCB decisions, either as minutes of CCB meetings or as copies of e-mails when a written procedure is applied.

If a system for electronic signatures is unavailable, the CM is delegated to physically sign forms when approvals are provided by e-mail.

On request, the CM is available to support, to explain, and to mentor any person involved in the procedure. External entities (Consortia) should channel their requests via the SKA Element Project Manager.

5.2 ECP Initiator

The ECP Initiator can be anybody within SKA or SKA related Contracts that has identified the need of a permanent change on an existing Configuration Item. Changes proposed from with Consortia are required to be co-ordinated with the Consortium Project Manager and Consortium System Engineer according to Consortia internal procedures.

It is task of the ECP Initiator to provide the first set of all relevant information that motivates the change, defines the change, the expected benefits, and the possible impacts.

5.3 SKA Consortium Project Manager (CPM) and the Element Project Manager (EPM)

The EPM is the responsible person on the SKA Office side, and the CPM on the Consortium side, for the Element related work package that is principally affected by the ECP.

The CPM role in this procedure can be either the actual WP Manager, or his/her delegated person. The CPM may be assisted by the CSE.

The CPM (for Consortia originated ECPs) or the EPM (for other ECPs) receives the ECP from the Initiator and after a compliance check provides the initial set of information that triggers the start of the process.

The SKA Element Project Manager together with the SKA Element System Engineer, then provide to the CCB a first technical and managerial evaluation of the ECP. During this evaluation clarification can be sought from the Consortium PM and the Consortium System Engineer. If needed, the EPM acts as CRB chair to coordinate any further detailed technical and managerial analysis and recommendations for the ECP as part of the CRB activities.

Finally, the Element PM receives the final decision for communication to the Initiator and he/she is also normally in charge of the follow up of the ECP implementation.

5.4 SKA Element System Engineer (ESE)

The SKA Element System Engineer (ESE) is the technical and procedural support to the evaluation of the ECP impacts.

Together with the EPM, the ESE furnishes the first assessment to the CCB.

5.5 Configuration Control Board (CCB)

The Configuration Control Board (CCB) is the ultimate authority to decide on the acceptance of an ECP and it mainly focuses on cost, schedule, performance and interface aspects. The CCB may request technical (and not only) support from the Change Review Board.

The exact composition of the CCB is defined in a dedicated memo by the SKA Director General who also chairs the Board. In general the CCB contains:

- The SKA Director of Science
- The SKA Architect
- The SKA Project Manager
- The SKA Chief System Engineer
- SKA Product Assurance Manager
- SKA Configuration Manager (secretary)

The CCB Chair shall nominate a deputy that has full authority in case of Chair absence.

The CM is the secretary of the CCB and has no decision or recommendation making power.

Irrespective of the processing of ECPs, the CCB will meet at least monthly.

5.6 Change Review Board (CRB)

The Change Review Board (CRB) is a board of experts, chaired by the relevant EPM that provides a detailed technical and managerial analysis of a System Level and Major ECPs, at the request of the CCB.

For each ECP, the CRB Composition is defined by the CCB based on a proposal from the EPM and ESE. This includes the nomination or identification of experts from Element Consortia.

Although he/she may be involved in the CRB for clarification and to provide additional information, the Initiator cannot be a voting member of the CRB.

In general, the CRB is made up of the following:

- Element Project Manager (chair)
- The SKA Office Domain Specialists of the affected Elements
- The Project Scientist or deputy
- Element System Engineer(s)
- WP Consortia Project Manager(s) and System Engineer(s) as required
- External experts as required
- ECP initiator (if required)

5.7 (ECP) Implementer(s)

The ECP Implementer is/are the entity/ies to which the implementation of an ECP decision is assigned, normally under the supervision of the WP Consortium Project Manager.

As appropriate, Consortium Agreement or Contract Amendment(s) may be needed to formally assign such tasks.

5.8 SKA Product Assurance (PA)

The Product Assurance function:

- provides expertise to the CRB when the EPM, ESE and/or CCB deems it necessary.
- receives from the CM, for information, a copy of the ECP at all the intermediate stages as well as the final disposition.
- can inspect and/or audit the ECP process at any time, as part of its Quality Control activity.

6 The Change Proposal Process

6.1 Creating an ECP

The need for a change may arise at different times, in different places, because different purposes. It is not always easy to understand at first whether there is really the need for a change. To reduce the probability of creating unnecessary ECPs, it is strongly recommended that preliminary discussions take place to understand the needs and the context. These discussions should include the Element Project Manager of the SKA Office.

As the need for a change is identified, the Initiator fills the ECP Submission Form (ECP-SF, see 7.1) and delivers it to the Consortium Project Manager.

The CPM (or EPM) and Initiator should jointly refine the definition of the change, removing inconsistencies, identifying the scope of the ECP (affected CIs and hence Element(s)) and, if needed, supporting documentation. This data should be sufficient to allow evaluation as described in 6.2.

The Initiator delivers the ECP-SF to the CM. The ECP title, description, etc must be carefully considered as they will be used through the whole process and cannot be changed later.

As the ECP Submission Form is received, within 3 working days the CM:

- Allocates a unique number
- Checks for formal consistency (number, fields, attached documents, etc.). If not complete, it is given back to Consortium Project Manager to correct. The ECP Control Form (see 7.5) is initiated.
- As soon as formal compliance is reached, the CM files the ECP-(SF_{FINAL} + CF_{draft}), with the status “in progress”
- Informs the Initiator that the ECP has formally started through the process.
- Maintains a folder where all relevant documents are collected until the final archiving step.
- Sends the ECP-(SF_{FINAL} + CF_{draft}) to the EPM and ESE to perform the first technical/managerial analysis. For information, a copy is also sent to the PA Engineer.

The last action starts the next phase.

If the EPM has requested to follow the ECP with high urgency (Fast Track), the ECP is submitted immediately to the CCB (see 6.3), otherwise it continues with the next phase.

6.2 First technical/managerial analysis

At this point, the SKA EPM can decide to delegate the following up of the ECP to another person.

The EPM and the ESE carry out a joint analysis of the ECP in order to have a first assessment of:

- The scope
- The impacts (cost, schedule, performance, interfaces)

If needed, the EPM and ESE can involve external experts as well as requesting clarifications to the Initiator and/or the ConsortiumPM and SE. If this took place, it shall be noted in the ECP-SE.

If sufficiently justified, the EPM can request to process the ECP with high urgency (Fast Track). The ECP is submitted immediately to the CCB (see 6.3), otherwise it continues with the next phase.

Based on this first analysis, the ECP is proposed to be classified into:

- MINOR (see 3.2 for the criteria).
- MAJOR (see 3.3 for the criteria).
- SYSTEM LEVEL (see 3.4 for the criteria).

The EPM and ESE also prepare a recommendation for the CCB to:

- Approve the ECP,
- Reject the ECP, or to
- Have a further technical/managerial analysis carried by a Change Review Board for which members are also identified.

The output of this phase is collected into the ECP System Engineering Recommendation Form (ECP-SE, see 7.2) that after being signed by the SE representative is then sent to the CM. In the case of disagreement between EPM and ESE, the responsibility of the recommendation lies with the EPM, but the disagreement has to be recorded in the ECP-SE. For information, copy to the PA Engineer is also sent.

The last action starts the next phase. It is expected that the maximum duration of this phase is less than 10 working days. Any exception to this shall be justified by the EPM and agreed with the CM.

6.3 Classification of an ECP

The CM submits the recommendation or the request for Fast Track to the CCB for a decision. The CCB can:

- Endorse the recommendation (System/Major/Minor, Accept/Reject, commit to a CRB)
- Decide otherwise. Explanatory comment is mandatory. If needed, any missing information has to be added (for instance, the CRB composition for a Minor ECP that has been reclassified into Major).

The CCB analyses can take place:

- During a CCB meeting. The CM records the decision in the CCB Minutes of Meeting.

- By exchanging of e-mails (written procedure). The CM collects the relevant mails in the ECP folder.
- In the case of Minor ECP (and no disagreement between EPM and ESE): if no explicit negative opinion is provided in writing within 5 days by any of the other CCB members, the PM/SE Recommendation is given to the CCB Chair for a final decision.

No matter how it has been reached, the CCB decision is recorded in the ECP-CF by the CM. For information, a copy is sent to the PA Engineer.

If the decision is not final, i.e., further detailed technical and managerial analysis are needed (CRB), the next phase is started (see 6.4) otherwise the process goes to its final phase (see 6.6).

It is expected that the maximum duration of this phase is less than 10 working days. Exceptions to this shall be justified by the CCB chair and agreed with the CM.

6.4 (If needed) Detailed technical/managerial analysis

According to the CCB decision, if the ECP needs further analysis, the CM initialises the CR Board Member Comment Form (ECP-BC-xxx, see 7.3) and the CR Board Report Form (ECP-BR, see 7.4) that are distributed, together with the rest of the ECP documentation so far produced, to the:

- EPM that is also the CRB Chair
- All other identified CRB Members

By meeting and/or written exchange the ECP is discussed and a final recommendation produced. If needed, the CRB can involve external experts as well as requesting clarifications to the Initiator. If this happened, it shall be noted in the ECP-BR.

The recommendation, if for approval, shall indicate a time limit for implementation.

The CRB Chair has the task to aggregate the individual opinions into a final report, the ECP-BR. Each CRB Member can also provide a written comment (ECP-BC- xxx, where “xxx” are the initials of the person). This is useful in the case of written discussion and it is necessary if there is disagreement between the CRB Member and the CRB Chair for the final recommendation.

Once ready, the CRB Chair delivers the ECP-BR and, if any, the ECP-BC-xxx signed forms to the CM. The last action starts the next phase. It is expected that the maximum duration of this phase is less than 20 working days. Any exception to this shall be justified by the CRB chair and agreed with the CM.

For information, a copy is sent to the PA Engineer.

6.5 Final decision

The CM collects all the information on the ECP up to this point, namely ECP-(SF + SE+ BC-xxx + BR) and submits it to the CCB for the final decision. For information, a copy is also sent to the PA Engineer.

Either by meeting or using a written procedure, the CCB makes a final decision and indicates a time limit for implementation. The decsion should take place within 10 working days.

6.6 ECP closing

Based on the final decision taken by CCB either after the initial analysis (see 6.3) or CRB (see 6.4) recommendation, within 3 working days the CM:

- Completes the ECP Control Form
- Creates a single document containing all ECP pages (SF, SE, etc.)
- Creates an archive of all correspondence and the evidence of written approval.
- Sends the complete file to the Element PM with an explicit approval/rejection. In the case of approval, the CM agrees with the EPM the timetable for implementation.

The Element PM then reports progress on implementation to the CM, and finally providing evidence of completed implementation (or cancellation due to further change) for notification to the CCB. The CCB Chair officially acknowledges closeout for recording by the CM in the ECP file. The closed ECP file is then deposited in the SKA Archive.

This ends the processing of an ECP.

6.7 Rejected ECP

If an ECP is rejected, because of open action items or unclear explanatory statements, the Initiator, after closing such these items, can raise a new ECP, with reference to the rejected one.

If an ECP is rejected, a new ECP with the same or very similar content can be submit again only if there are new conditions that justify to reconsider the change. Evidence of that has to be provided in the ECP SF.

6.8 Implementation

As the final version is received, the EPM should progress with the implementation. Depending on the specific case, Contract Amendments may be needed

The CM keeps a record of the planned due date and the effective one.

6.9 Time table

The following table summarises the expected duration in working days of every task foreseen by the procedure. System Level ECPs are allowed the same time as Major ECPs subject to CRB resource availability (i.e. the analyses cannot be conducted in parallel).

Step	Action	Major	Minor	Fast Track
1	CM creates ECP with SKA Element Project Manager input (see 6.1)	3	3	3
2	SE and SKA Element Project Manager first analysis and recommendation (see 6.2)	10	10	-
3a	CM sends ECP to CCB for decision	3	3	-
3b	CCB decides	10	5	10
4a	CM sends ECP to CRB	3	-	-
4b	CRB provides detailed analysis and recommendation	20	-	-
5a	CM sends ECP to CCB for decision	3	-	-

5b	CCB final decision	10	-	-
5c	*Change is implemented*	*varies*	*varies*	*varies*
6	CM formalises and sends to archive final ECP documentation	3	3	3
	Maximum ECP processing elapsed time (in working days)	**65**	**24**	**16**

Table 2 : Timetable

Special periods, like Christmas, Easter, Summer, ... Holidays, are not considered as available time, though activities may take place depending on staff availability. The exact calendar is set by the CCB on a quarterly basis.

Following receipt of a justified request of an interested party, the CM can extend a deadline.

Unless authorized by the CCB, the process of an ECP should not take more than 6 calendar months.

An ECP delayed without justified reasons or reaching the maximum elapsed time without any on going action are closed/rejected by the CM who then notifies all involved parties.

7 ECP Forms definition

The ECP process uses a separate form for each step. Each form has only one physical signature (that in the case the approval is given in writing (e-mail) is delegated to the CM.

The ECP forms are:

- ECP Submission Form (ECP-SF)
- ECP System Engineering Recommendation Form (ECP-SE)
- ECP Board Member Comment Form (ECP-BC-xxx)
- ECP Board Report Form (ECP-BR)
- ECP Control Form (ECP-CF)

The collection of all the forms used in the process of a single ECP constitutes the ECP document that is archived at the end of the process. The ECP Control Form collects the key data of an ECP. ECP Board Member Comment and the Board Report are used only for the ECP for which a CRB is requested.

ECP forms will be implemented electronically, and their format is TBD until the appropriate management system is in place.