

# INTEGRATION - O&M INTERFACE

## Crossrail Systems Integration Review Panel (SIRP 2) Terms of Reference & Management Procedure

**Document Number: CRL1-XRL-O8-GPS-CR001-50016**

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4.0	10/06/16	David Rix	Graeme Overall	Jeremy Bates	New SIRP 2 Workshop Process
3.0	15/10/15	Jim Claxton	Sidharth Dawar	Siv Bhamra	Incorporation of IM’s to Panel Membership

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4.0	Introduction of new SIRP 2 process

## Contents

1	Membership.....	4
2	Frequency of Meetings .....	4
3	Aim .....	5
4	Objective .....	5
5	Definitions.....	6
6	The Original Process: .....	6
	Cases considered.....	6
	CASE 1: Contractor submits design change or progressive design refinement.....	7
	<b>Identification stage</b> .....	7
	<b>Assessment stage</b> .....	7
	<b>Delivery stage</b> .....	7
	CASE 2: Operations Concept change or refinement considered for impact on design.....	8
	<b>Identification stage</b> .....	8
	<b>Assessment stage</b> .....	8
	<b>Delivery stage</b> .....	9
	CASE 3: SIRP determines need for Operations Concept and design change.....	9
	<b>Identification stage</b> .....	9
	<b>Assessment stage</b> .....	9
	<b>Delivery stage</b> .....	10
7	Current Process.....	10
8	Action Tracking.....	13
9	Reporting.....	13
10	Governance .....	13
11	Reference Documents .....	14
12	Standard Forms/Templates .....	14

## **CROSSRAIL LIMITED**

### **The Crossrail Systems Integration Review Panel (SIRP)**

#### **Terms of Reference & Management Procedure**

## **1 Membership**

Chair: CRL Head of Operations and Maintenance Strategy

(In his absence, the Members present may elect a Chair for the meeting from amongst themselves)

Members: Head of Assurance & Integration CRL  
Head of System Safety and Interoperability CRL  
Principle Engineer Rolling Stock & Depots CRL  
Operations Principles Manager CRL  
Operations & Maintenance Manager LUCT  
Head of Engineering LUCT  
Head of System Engineering RfL  
Systems Engineer RfL  
Head of Operations RfL  
Head of Maintenance RfL  
Deputy Operations Director RfL  
Operations Standards Manager RfL  
Systems Assurance Manager MTR Crossrail  
Operations & Maintenance Specialist CRL  
Maintenance Planning Engineer CRL

Observer: Crossrail PRep

By Invitation: Contractors / Technical Specialists as required. Network Rail representatives to be also invited on an 'as required' basis along with Lead Operations Development Specialist RSSB

## **2 Frequency of Meetings**

Meetings will be held four weekly or as otherwise agreed. Additional meetings of the Systems Integration Review Panel may be called as agreed by the Chair.

### **3 Aim**

The System Integration Review Panel and the activities it sponsors exist to provide assurance of the operability of the completed Central Operating Section assets and the interfaces with the existing operators' equipment.

The System Integration Review Panel is the forum where the following project-wide activities are managed and undertaken:

- Validate the alignment between the baseline designs and operations concepts. This was the focus of the SIRP 0 & SIRP 1 tranches completed in 2015. As the design progresses, this will evolve into the validation of the alignment between the Detail Designs, Engineering Safety Justifications and the relevant operational procedures, plans / rules.
- Provide formal operability impact assessment in support of the Crossrail Change process, as required
- Sponsor the deployment, management and dissemination of integrated engineering / operations reviews, and any other assessments / reviews / studies that are deemed as required by the panel; eg Human Factors Studies and Performance Modelling.
- Assist with the management and co-ordination of the Railway Baseline Operations Concepts.
- Act as a sponsoring authority for formalising changes arising through design led SIRP workshops and managing the configuration and the misalignment between the current design and the design upon which Operations Concepts (OCs) are predicated.
- In stage 2 (SIRP 2), conduct "use case" based workshops to examine operability of sub-systems and integration thereof and to manage potential outcomes from any demonstrable lack of such reasonable operability or integration. .
- Support and monitor the development and adoption of rules and procedures by the relevant IM or TU which arise from the CRL design and integration processes
- Maintenance integration Reviews are reported to SIRP by the Maintenance Planning Engineer at the 4 weekly meetings.

### **4 Objective**

The panel shall:

- Review and assess the implication of change (either design or operational) as instructed by the System Technical Authority, Technical Authority Group or Railway Integration Authority
- If further analysis is required, the panel shall propose the appropriate method of evaluation, e.g. SIRP workshop, further study.
- Agree the scope (e.g. definition of scenarios) and timing of the above.
- Track for completeness, ownership, dissemination and resolution of any actions arising from the above and determine escalation of issues relating to this process and report through the System Technical Authority and the Railway Integration Authority.

## **5 Definitions**

CEG – Chief Engineer’s Group

CRG – Client Review Group

CRL – Crossrail Limited

MTR –Crossrail Train Operating Company (Concessionaire appointed by RfL)

EM – (Crossrail) Engineering Manager

CCSC – Change Control Sub Committee

IMs – Infrastructure Manager(s)

OC – Operations Concepts

Ops.Dir. – Operations Directorate

PM – (Crossrail) Project Manager

SIRP – Systems Integration Review Panel

MIRP- Maintenance Integration Review Panel

Tech.Dir – Technical Directorate

TU- Transport Undertaking

RSSB- Rail Safety and Standards Board

DITLO- Day In The Life Of

## **6 The Original Process:**

**SIRP 0 & 1 through to 2015, SIRP considered the alignment of the Operations Concept and the Design as follows**

### **Cases considered**

Three cases are defined below to manage and process the misalignment between current design and CRL Baselined Operations Concepts; these are:

- **CASE 1: Contractor submits design change or progressive design refinement.**

In this case CRL becomes aware that a designer or delivery contractor proposes to make a change or refinement to an agreed design, which must then be tested for continued operability and must go through CRL’s normal change governance process, which may result in a changed OC.

- **CASE 2: Operations Concept change or refinement considered for impact on design.**

In this case the Operations Team proposes a change or refinement to the way that Crossrail will be operated, via a change to an OC. This must be assessed for any impact upon design, and must go through CRL’s normal change governance process.

- **CASE 3: SIRP determines need for Operations Concept and design change.**

In this case, SIRP, through its normal review workshops becomes aware that there is an incompatibility between emerging designs and OCs. Both are assessed, changes are proposed and all must go through CRL’s normal change governance process.

The method to be followed for each is set out in the below sections also refer to Appendix A for relevant flowcharts:

**CASE 1: Contractor submits design change or progressive design refinement.**

**Identification stage**

A designer proposes a change to some element of a design, or a contractor provides an *Issued for Construction* document that differs from what was previously agreed. The generic term 'change' is used, though the actual scope may range from a major change to a refinement emerging from progressive design.

The CRL PM or EM checks the extent of the change and issues a Change Proposal. Either the PM/EM or the Designer/Contractor may be the Change Owner. These change proposals gets documented on Gate Impact report (as part of Engineering Design assurance Gates Procedure) which gets issued to CEG (Tech. Directorate) to assess the impact or revalidate the design against the changes. The CEG (Tech. Directorate) will in turn issue the Gate Impact Report to the SIRP Panel to assess the impact of changes on the operations & maintenance.

**Assessment stage**

The relevant team within Tech.Dir. Assesses the impact of the change on Integration, ESM, and Maintenance. Crucially, it also assesses whether the change will have an operational impact. Since the true arbiter of operational impact is SIRP, this assessment serves only as a 'heads-up' for TRG, SIRP and Operations if it is considered to have an impact.

This early warning primes TRG, SIRP and Operations to the possibility of a change to OCs. Operations may choose to develop draft wording at this stage, which can be subsequently submitted to SIRP.

Whether or not there is a possible operational impact, the Change Proposal progresses through the standard Change Control process. This requires it to be assessed by CRG, PCRG, and TRG and then approved or rejected by ICSC (this process and the ToRs of these groups are documented elsewhere in Crossrail programme change control procedures).

As part of its assessment, TRG may wish to refer the change to SIRP, for a more detailed assessment. For this, SIRP compares the proposed change with the current baselined OCs. Any detected impact may help or hinder operations. Ops.Dir. is represented on SIRP and may propose its own changes to OCs that would accommodate the design change yet still remain operable. SIRP reports back to TRG which incorporates SIRP's findings into its own forward assessment to ICSC. (NB: If SIRP determines there is no impact on Operations, it says so and no change to OCs is required.)

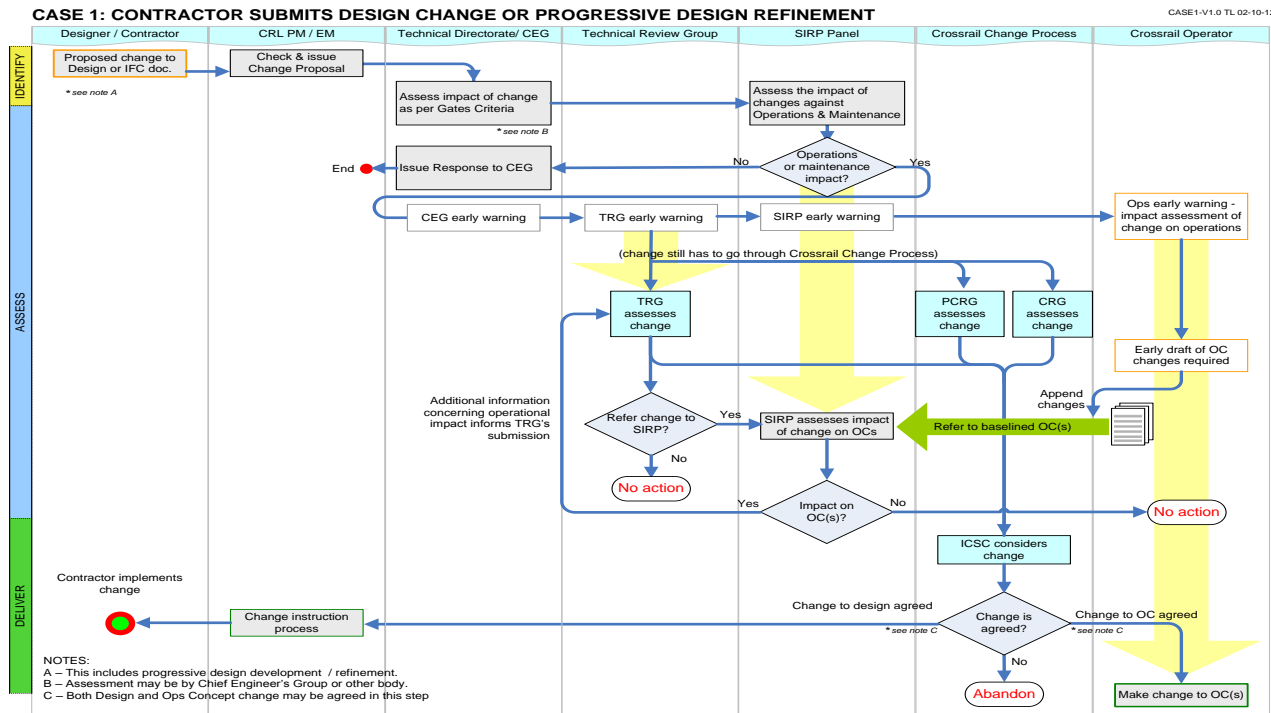
At this stage, a Change Proposal may contain the original design change, plus any resultant impacts upon operations, including suggested changes to the OCs.

**Delivery stage**

ICSC considers the submissions from TRG, CRG and PCRG and approves or rejects the Change Proposal, either in part or in total.

If the Change Proposal is accepted, the design change is instructed via the PM/EM and independently the Ops.Dir. is given permission to make a controlled change to the OC(s). Depending on volume and timing, the Ops.Dir. may wish to hold and batch-process changes to OCs, re-baselining as necessary.

If the Change Proposal is rejected, the whole of it is rejected, thus there is no impact upon the OCs.



**CASE 2: Operations Concept change or refinement considered for impact on design.**

**Identification stage**

Ops.Dir. proposes a change to some part of the OCs. This may be a major change (e.g. brought about by legislation, changes in best practice etc.) or more likely will be a refinement of detail in the way the railway is to be operated. Operations draft a Change Proposal and is named as the Change Owner.

Operations issues the Change Proposal to SIRP, which at the earliest opportunity checks it against the current Civils / MEP / System designs.

**Assessment stage**

If SIRP considers there will be an impact on design, it alerts TRG, which in turn engages with the relevant group(s) within the Tech.Dir. The original Change Proposal is used as the record of the proposed OC change, and this may be amended by impact information from TRG or Tech.Dir. If Tech.Dir. believes there may be an impact on design, it may instruct the PM or EM to initiate an impact assessment from the designer or contractor. When this has been returned and evaluated, the EM/PM further amends the Change Proposal, adding the designer/contractor's assessed impact on design (this must contain data in a suitable format as required by CRG, PCRG and ICSC).

If SIRP considers there is no resultant design impact resulting from the OC change, it must still consider whether the proposed change in the OC requires the Change Control process to be invoked (if there is significant content change, even if this is merely a refinement, a change to the document would be invoked). If the change is trivial, then SIRP notes this and instructs Ops.Dir. to make the change anyway. This would be the case for minor corrections, errata or formatting changes.

Once the CRG/PCRG/TRG/ICSC Change process is in train it follows its normal course (TRG having had early warning of the change).

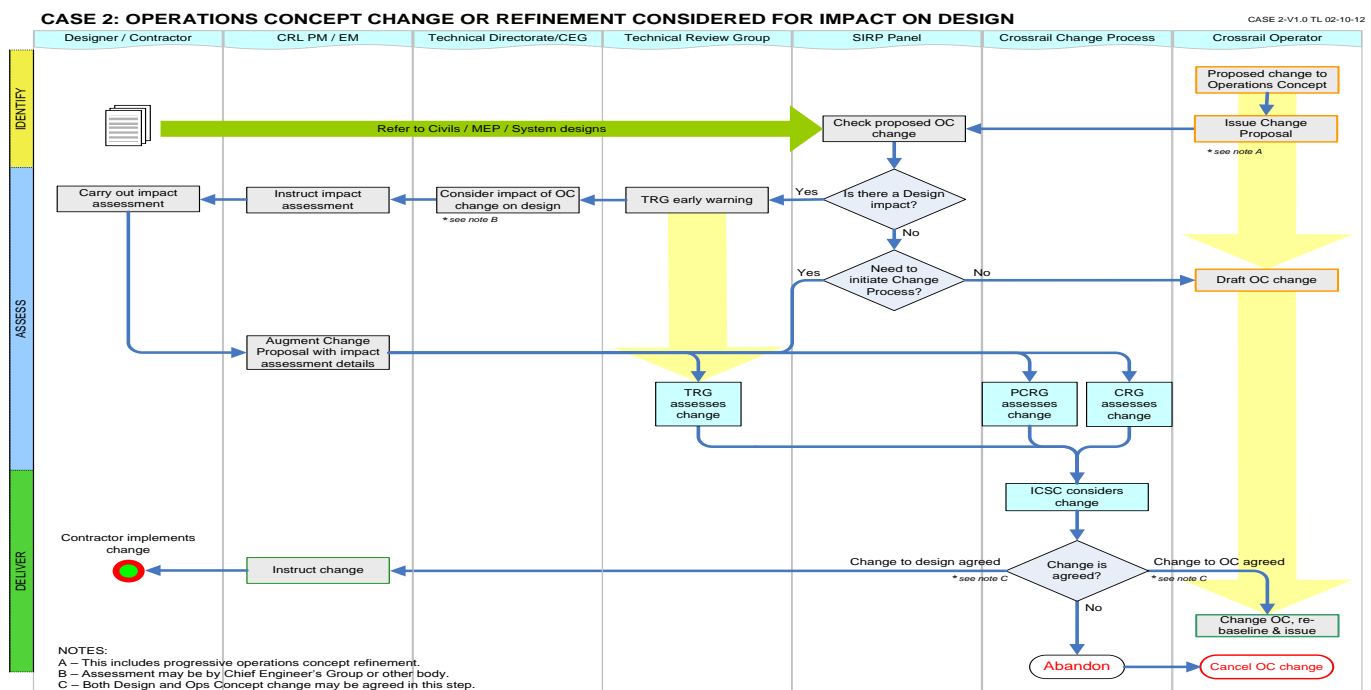


**Delivery stage**

ICSC considers the submissions from TRG, CRG and PCRG and approves or rejects the Change Proposal, either in part or in total.

If the Change Proposal is accepted, the design change is instructed via the PM/EM and independently the Ops.Dir. is given permission to make a controlled change to the OC(s). Depending on volume and timing, the Ops.Dir. may wish to hold and batch-process changes to OCs, re-baselining as necessary.

If the Change Proposal is rejected, the whole of it is rejected, thus there is no impact upon the OCs. In this case, the OC change is abandoned.



**CASE 3: SIRP determines need for Operations Concept and design change.**

**Identification stage**

In this case, SIRP becomes aware of a disparity between the current designs and the published OCs. As before this may be a significant gap or simply a question about detail. SIRP documents this disparity.

**Assessment stage**

SIRP applies the test “Does this design remain operable?” If the gap does not present a problem, nothing need be done. If the gap presents a risk to operability, SIRP may request a rewording of OC(s) and/or a request – via TRG and the Tech.Dir. – for a contractor’s impact assessment, as Case 2 above. Up to now, no Change Proposal has been created. As a by-product of this, TRG has an early warning of a possible impending change.

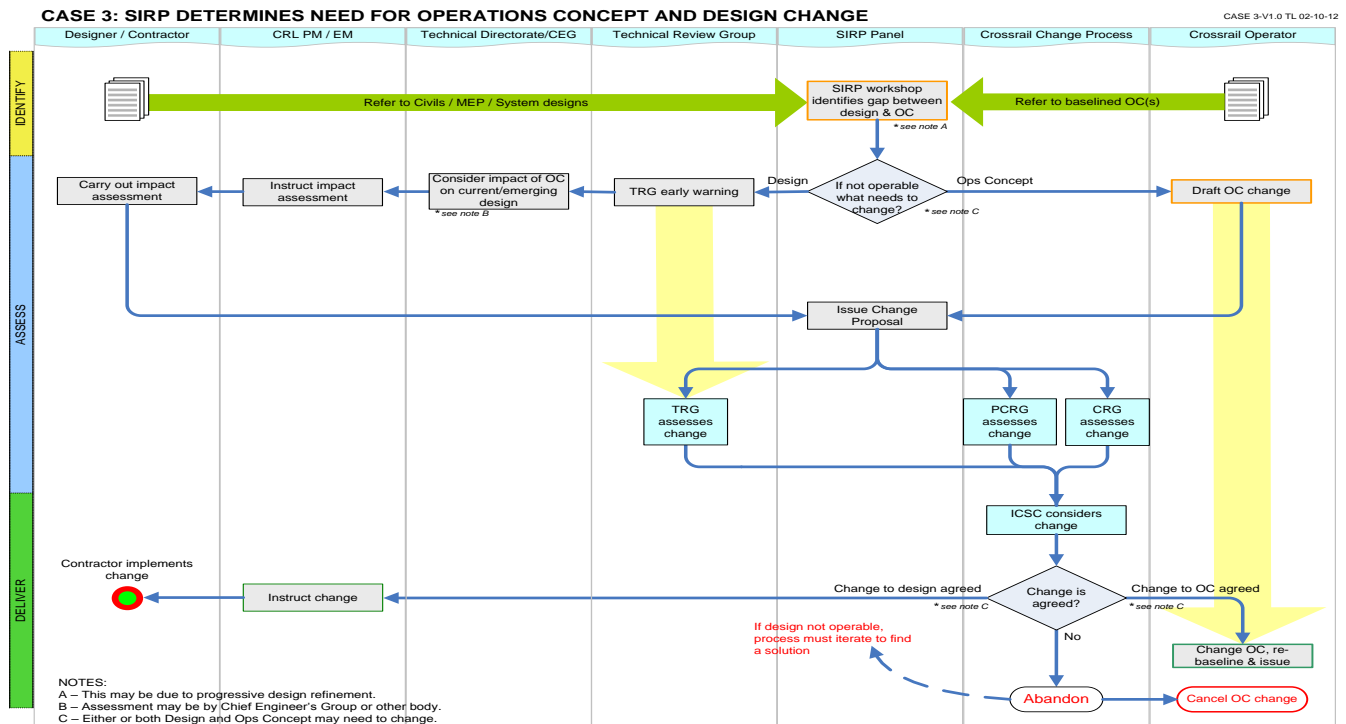
Upon receipt of the contractor’s impact assessment and any changes to the OCs SIRP initiates and takes forward a Change Proposal (and is named as the Change Owner).

From this point the assessment follows the conventional TRG/CRG/PCRG/ICSC governance process as previous cases.

**Delivery stage**

If ICSC approves the change, then as previous cases, a design change and OC change may be instructed.

If ICSC rejects the change, then all proposed changes are abandoned, however it is noted that since SIRP has determined that an element of the design has become inoperable, an iteration of Case 3 MUST be carried out until a solution is found.



**7 Current Process**

SIRP 2 represents an evolution of the process of providing assurance of interoperability reflecting nearly complete design and increasing preparedness of operating organisations. Whilst administration of the process remains the responsibility of Crossrail the Chairs role transfers to the actual end users i.e. RfL Operations - representing the routeway Infrastructure Manager's (IM) operations role; MTR Crossrail - representing train operations and the station IM's operations roles and London Underground (LU) as IM for 5 Central Operating Section stations. LU is invited whenever scenarios concern their stations. Other cases may involve NR or other Operators where applicable.

The methodology borrows from the system engineering discipline in the adoption of 'use case' (i.e. instances of use) analysis, an approach which has been successful on other projects such as Thameslink. The aim is to capture systematically all scenarios where the user interacts with the system and where those scenarios are characterised by novelty, complexity or particular risks leading the panel to require use case analysis, DITLO analysis may be used to support prioritisation of the scenarios for the use cases.

Such an approach supports associated work streams including Rule Book and local instruction writing, and the development of training packages for operating personnel. It also helps in assuring that interface functionality works correctly, and that interface hazards are fully driven out.

## **Use Cases**

Use cases are commonly used in the development of software based systems to document all the users' interactions with the software. Each interaction is based on the concept that the user needs to achieve a particular goal, and in doing so the system will move from one state (prior to the use case's execution) to another (post its execution). All the interim states and actions performed by both the equipment and the user are written down in a template. Optionally the transactions can be shown in diagrammatic form, for example by using swim lane diagrams. Once the 'successful execution' scenario is completed, all the things that could go wrong during execution are considered and also documented. By definition, in documenting all use cases for a system all the functionality required of that system is captured.

A typical use case structure is as follows:

- ID – a unique identifier for the use case.
- Title – a meaningful and easily understood title.
- Description – a short paragraph explaining what the use case is and does.
- Actor list – the set of actors involved in the use case.
- Pre-conditions – any required conditions which must obtain before the use case can start, expressed in terms of actors and necessary states.
- Trigger – the event, if applicable, which causes the use case to start.
- Flow – a sequential list of actor interactions described in terms of the information presented from one actor to another, and any actions an actor must take to move the flow on. Written in terms of what the actors do, not how they do it.
- Exceptions – subsets of the flow describing what happens when an error or unexpected condition occurs.
- Post-conditions – any pertinent conditions which will irrevocably exist at the use case's termination.

The entities involved in each scenario are known as 'actors'; note that the term includes both the users and any systems with which they are interacting. For our implementation we consider a basic breakdown of internal systems (those Crossrail is delivering) and existing external systems, all of which are considered to be actors.

The key principles of this approach are that;

- it covers a sample of all system functions involving user (operator) interaction,
- it operates at a greater level of detail than SIRP 1, checking usability and operability,
- it is operationally led, and conducted to a level of quality satisfactory to all parties
- it will be conducted with the primary aim of demonstrating operability of the system being delivered, not as a vehicle for opinion engineering or imposing operator preference.

## **Methodology**

SIRP 2 sessions are held on a regular basis as opposed to ad-hoc as previously, and of fixed length (the plan is for one half day per fortnight). This assists in diary planning and commitment.

Sessions are kept as small as possible to cover the scenarios to be analysed on the day. If scenario analysis is not completed in one session it continues at a future session (i.e. the quality of analysis should not be compromised by running out of time) to suit the availability of the required attendees. Scenarios are generated to capture new and novel functionality only; no attempt is made to capture instances where the railway operates in a wholly conventional fashion (though these will need to be borne in mind when writing the operational procedures themselves).

Sessions are chaired or co-chaired by the RfL Operations team, MTR Crossrail and LU as appropriate; RfL may invite the RSSB, who are providing technical authorship of the COS Rule Book and RfL System Engineers may also be invited to participate, CRL Operations are also invited. If nominated members are unable to attend then they must delegate a deputy to attend if possible. If due to resource issues there people are unable to attend there will be a quorate of at least 3 workshop panel members that will need to be present, this must consist of at least 1 representative from CRL and 1 each from the IM's and TU's. Wherever possible the aim will be to keep the total number of attendees to a maximum of 8-10 persons, including designer representation. In order to facilitate efficient operation of the sessions, attendees will be expected to attend the meetings having undertaken preparatory work. CRL O & M interface team provides facilitation of the meetings and arranges necessary engineer participation.

The "Use Case" process is time consuming, and assurance of operability does not of course require that all operating scenarios are subject to this analysis.

A master schedule/tracker of scenarios showing titles and brief scope descriptions will be drawn up on a prioritised rolling basis and added to or otherwise amended as required. The completeness of this scenario list will be tested by conducting DITLO ("day in the life of") checks for the principal actors. The completion status for each scenario will be progressively logged in the tracker and reported to SIRP. SIRP may also agree to changes to the list of "Use Case" scenarios to reflect the outcomes of DITLO exercises.

A master list of actors (users and subsystems) will also be created and regularly reviewed. With respect to subsystems this will need to be broken down to specific elements (e.g. HMIs) with which the user interacts. Again the list will be reviewed periodically and checked with the Systemwide designers.

The sessions may generate issues requiring action which will be recorded on the SIRP 2 action tracker, each issue being linked to the UC in which it was encountered. Each issue will comprise a description, an owner, proposed associated actions, a criticality status and a date (or programme milestone) for resolution. Issues will be reported to SIRP and their status and actions ratified.

Designers will be expected to bring suitable design documentation as evidence to the sessions. Evidence will be sought to a level sufficient to validate the claims the designers are making and might include design description documents, drawings, CAD visualisations etc.

## **Programme**

Sessions will commence in January 2016 and are expected to be held on a two-per-period basis. If the programme is delayed for any reason the frequency may increase with the agreement of participants. The Programme is aligned with the Final Design Overview process and will be completed before the end date for FDO's which is July 2017

## **8 Action Tracking**

This will be the responsibility of CRL and will be tracked using a dedicated SIRP 2 tracker on eB ref: **CRL-XRL-K2-RGN-CR001 50004**.

## **9 Reporting**

The group shall report outputs to the System Technical Authority. They shall include:

- Issues uncovered
- Actions closure progress

## **10 Governance**

Reports shall be issued to:

- Systems Technical Authority (STA)
- Key issues will be raised at the Railway Integration Authority (RIA)

## 11 Reference Documents

<b>Ref:</b>	<b>Document Title</b>	<b>Document Number:</b>
1.	Change Control and Budget Management Procedure	CR-XRL-Z9-GPD-CR001-50003
2.	Suite of Operations Concepts	CRL1-XRL-K2-GUI-CR001_Z-50001 to CRL1-XRL-K2-GUI-CR001_Z-50028
3.	Terms of Reference of: CCSC	CR-XRL-Z6-STP-CR001-50026
4.	Terms of Reference for System Technical Authority	CRL1-XRL-Z6-STP-CR001-50004

## 12 Standard Forms/Templates

<b>Ref:</b>	<b>Document Title</b>	<b>Document Number:</b>
A.	none	
B.		