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## Digital Railway - Operational Readiness Plan

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### Version History

Issue	Date	Comments
0.1	14 <sup>th</sup> March 2018	Initial Draft
1.0	25 <sup>th</sup> April 2018	Update following peer review

### Exclusions

These are items currently missing from this version of the document that should be included in a later publication.

1. Best endeavours have been used during the development of this document to incorporate the relevant content of the DRP Concepts of Operations documents which have been updated in parallel. Final alignment with the relevant industry-endorsed Concepts of Operations will be achieved in a later version.
2. This document describes the activities required to deliver requirements for operational readiness covering rules, processes, training and maintenance. Further Operational Readiness activities described in [RD4] will be required after the conclusion of this work. The plan for these activities will be included in a later version of this document.

### Assumptions

These are items upon which the validity of this document relies and which will be delivered by others. Non-delivery of these items will necessitate a change to this document.

None

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### Dependencies

There are items upon which the validity of this document depends. Any changes to the referenced document may require further changes to this document.

1. Digital Railway System of Systems Architecture [RD2]

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## REFERENCES

### Dependant References

An update to one of these references requires an update to this document

*Note: References should be used in sequential format throughout this document.*

- RD1 Digital Railway Programme – Vision, Purpose, Objectives (DRAFT), issued by email 19th December 2016 by Digital Railway Comms.
- RD2 System of Systems (SoS) System Definition 153819-REP-DRP-ESE-000002 Version 4.0,
- RD3 Digital Railway – System of Systems Basis of Design, 153819-NWR-REP-ESE-000002. Version 1.0
- RD4 Digital Railway Programme – System Management Plan, 153819-NWR-PLN-MPM-000002, Version 5.0.
- RD5 Digital Railway Programme – Interface Description Document, 153819-NWR-RCD-ESE-000001, Version 4.0
- RD6 DRP System Safety Plan 147883-NWR-PLN-MPM-000008, Version 2.0
- RD7 DRP Hazard Management Plan 147883-NWR-PLN-MPM-000005 Version 1.0.
- RD8 DRP SoS Customer Requirements Specification, 153819-NWR-SPE-ESE-000003. Version 1.0

### Informative References

These references have no material bearing on the content of this document.

- RI1 Digital Railway Requirements Management Plan. 153819-NWR-PLN-ESE-000006 Version 1.0
- RI2 Digital Railway – Glossary of Terms & Abbreviations 153819-NWR-SPE-ESE-000001 Version 1.0
- RI3 Digital Railway – Requirements Change Control Process, 153819-NWR-SPE-ESE-000004, Version 1.0

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# 1. Introduction

## 1.1 Background

Digital Railway is a rail industry-wide programme designed to benefit Great Britain's economy through more effective train operation, customer experience and industry adaptability, enabled by accelerating the application of digital technologies to the railway. The benefits of the Digital Railway are expressed as:

- More trains
- Better connections
- Improved reliability

These are to be delivered by the Digital Railway Programme to GB Rail through the application of modern train control technology. The vision, purpose and objectives have been summarised as [RD1]:

- Increased capacity
- Safer, more secure & environmental railway
- Improved train performance (reliability and availability)
- Improved whole life cost and sustainable commercial model
- Wider socio-economic benefits (e.g. skills, productivity, housing, exports)

This is an industry-wide programme involving Network Rail (as Infrastructure Manager), Train and Freight Operating Companies (as Railway Undertakings), RSSB, Yellow plant and the supply chain. It will also engage with the Regulator and the Department for Transport (DfT) as necessary to secure the required improvements to safety and customer provision, funding and approvals.

## 1.2 The Digital Railway Programme (DRP)

The Digital Railway Programme has several principal outcomes. These are:

1. Creation of a generic customer requirements for deploying Digital Railway (DR) Systems (using European Train Control System (ETCS) Level 2, Traffic Management (TM), Connected Driver Advisory System (C-DAS) and for interfaces with other systems and enablers).
2. Preparation of business cases that provide input to Route strategic business plans for deployment projects using specific applications of DR Systems.
3. Assisting deployment projects to deploy specific DR Systems as a result of the Business Plan work undertaken in 2 above.
4. Production of guidance notes, rules, processes and templates to help deployment projects. Where remitted, DR will provide support to deployment projects in determining the deltas between the DR System of Systems (SoS) items and their particular deployment.

In the context of the DR Programme, the term '**System**' refers to the various digital technologies to be deployed (i.e. European Train Control System (ETCS) Level 2, Traffic Management (TM), C-DAS and other systems and enablers).

**System of Systems (SoS)** refers to their integration in a baseline architecture to enable the full benefits of the digital technologies to be realised.

Both terms include more than just the systems themselves, but also the people, processes and data required to enable operation.

Within the DR Programme, the System Requirements and Integration (SR&I) team is charged with producing the outputs required under items 1 and 4 above.

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### 1.3 Context & Purpose of this Document

Operational Readiness is the measure of operational preparedness of the industry's operations and maintenance staff to accept Digital Railway Technologies. Those who operate DR technologies require all necessary operational processes, training and rules to be in place to ensure that the railway can be run safely and efficiently. This operational readiness is required prior to implementation, to enable the benefits of Digital Railway (DR) technologies to be fully realised.

This Operational Readiness Plan describes the activities required for the creation and development of Generic Operational Readiness Requirements, which will inform the operational and maintenance processes, training and rules that will need to be put in place.

This document does not cover the processes to be used for the ongoing management of the requirements once they have been developed or any subsequent changes. This information is contained within the DRP Requirements Management Plan [R11] and the DRP Requirements Change Control Process [R13].

### 1.4 Scope

This document covers only the DR Operational Readiness Requirements activities in order to deliver a full set of Operational Readiness Requirements by November 30th 2018.

This operational readiness work will consider the deployment of the DR SoS configuration only and does not consider how a particular section of the railway might operate or be maintained if technologies are deployed in any other configuration.

Any variation from a full deployment of the DR SoS Configuration will need to be addressed by the particular deployment project (both Infrastructure Manager and Railway Undertakings) concerned, using the DRP generic outputs as a baseline.

### 1.5 Document Maintenance

This Document is owned by the Lead Architect for Operational Readiness. This document has presumed a particular baseline technical solution, called the DR SoS, as outlined in the SoS System Definition document.[RD2].

However, if during delivery of this plan, a different technical solution comes to light that would also achieve the Digital Railway primary objectives, then these will be considered. An update to this document may then be necessary. The DR systems engineering governance structure is defined in [RD4], which covers the systems activities within DR. This document is subordinate to the DRP System Management Plan [RD4].

The results of the Operational Safety Hazard Analysis, changes to the requirements suite and any future human Factors studies will inform this plan, and may necessitate changes in the future.

## 2. Roles & Responsibilities

### 2.1 Operational Readiness Lead Architect

The Lead Architect will be responsible for ensuring that all activities described within this document are performed in accordance with this plan including:

- managing the operational readiness activities performed by the SR&I team;
- producing and maintaining this document;

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## 2.2 SR&I Team

The SR&I team has an operational readiness work stream within it, and this work stream team, led by a Lead Architect, is responsible for performing the operational readiness requirements specification and associated output delivery activities in accordance with the processes contained within this plan and as directed by the Lead Architect.

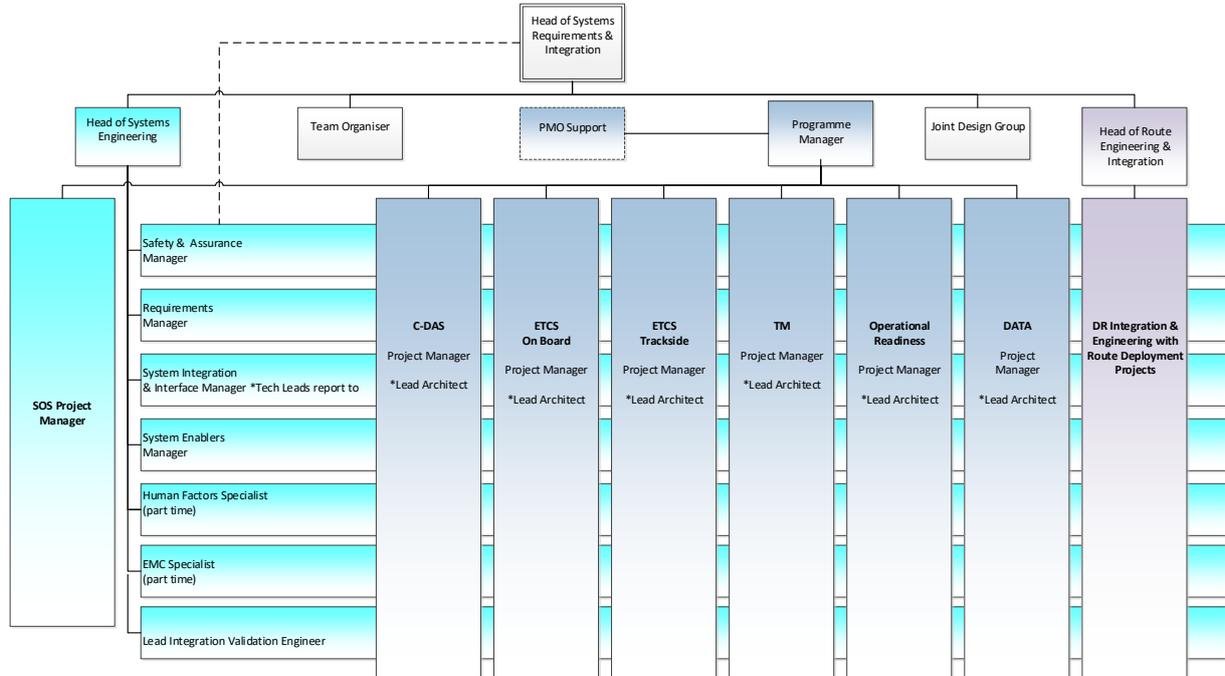


Figure A:SR&I Organisation

## 2.3 Competence and Training

The SR&I team has a competency management process that ensures all competencies identified as being essential for the roles within the team have been met. These competencies are all recorded per team member within the SR&I Team Competency Matrices.

# 3. Background

## 3.1 Operational Readiness Background

The original development activities for each of the component systems, particularly ETCS, considered the rules, training and process requirements as part of the system design, and there are a large number of pre-existing requirements which have been agreed by the industry. Subsequent activities to develop training materials, and develop rules, processes and procedures have taken place using these requirements as a baseline. However, no detailed work has yet been done to look at Operational Readiness from a System of Systems point of view.

In an environment where deployment projects are looking to procure DR systems as soon as is practicable, it is essential that DR has a robust set of operational readiness requirements to support the SoS generic baseline and associated specifications to aid deployment of DR technologies.

This is particularly important for requirements that specify changes to the National Rule Book, as the industry agreed process for delivery of rules changes can take a significant period of time. The risk of not having these requirements in place is that deployment projects will generate their own rules, procedures and processes which will result in differing modes of operation across different parts of the GB network.

The operational readiness requirements are illustrated in the context of the DRP generic requirements as follows:

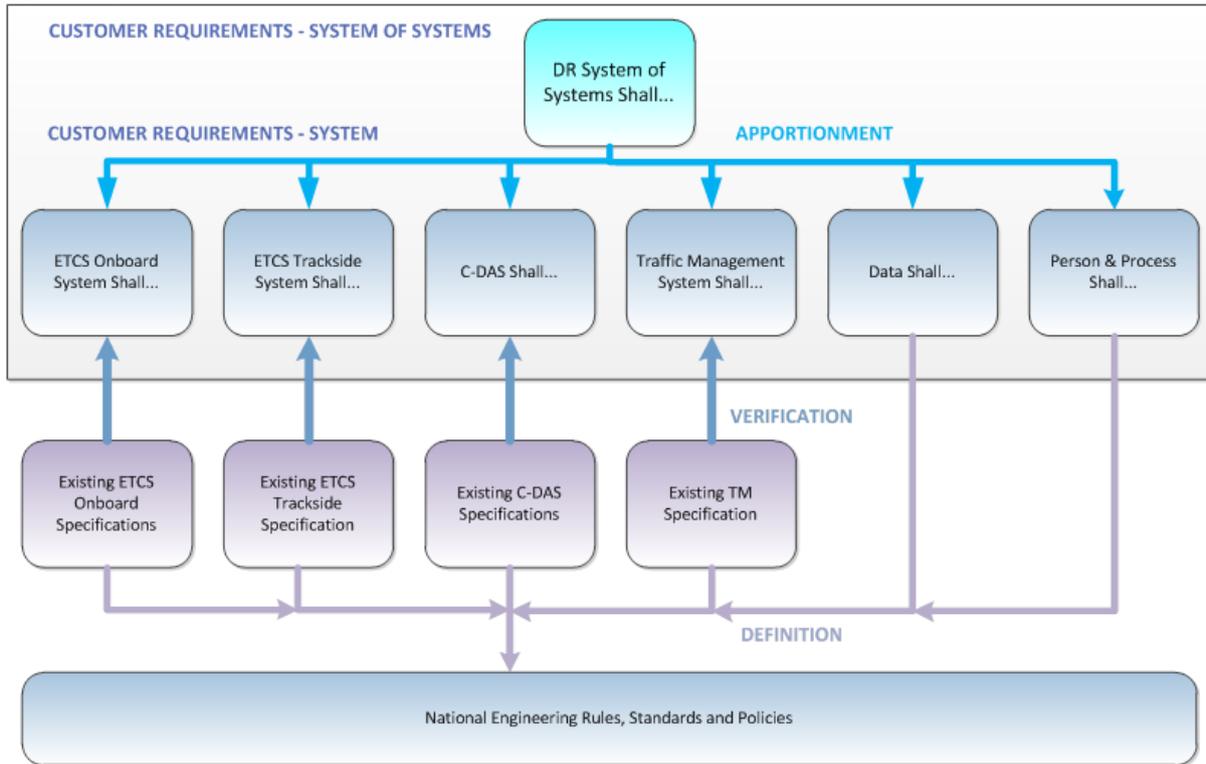


Figure B: DR System of Systems Requirements Structure

This diagram also illustrates how the National Engineering Rules, Standards and Policies will be developed by DRP, in collaboration with the deployment projects.

### 3.2 System Architecture & User Interactions

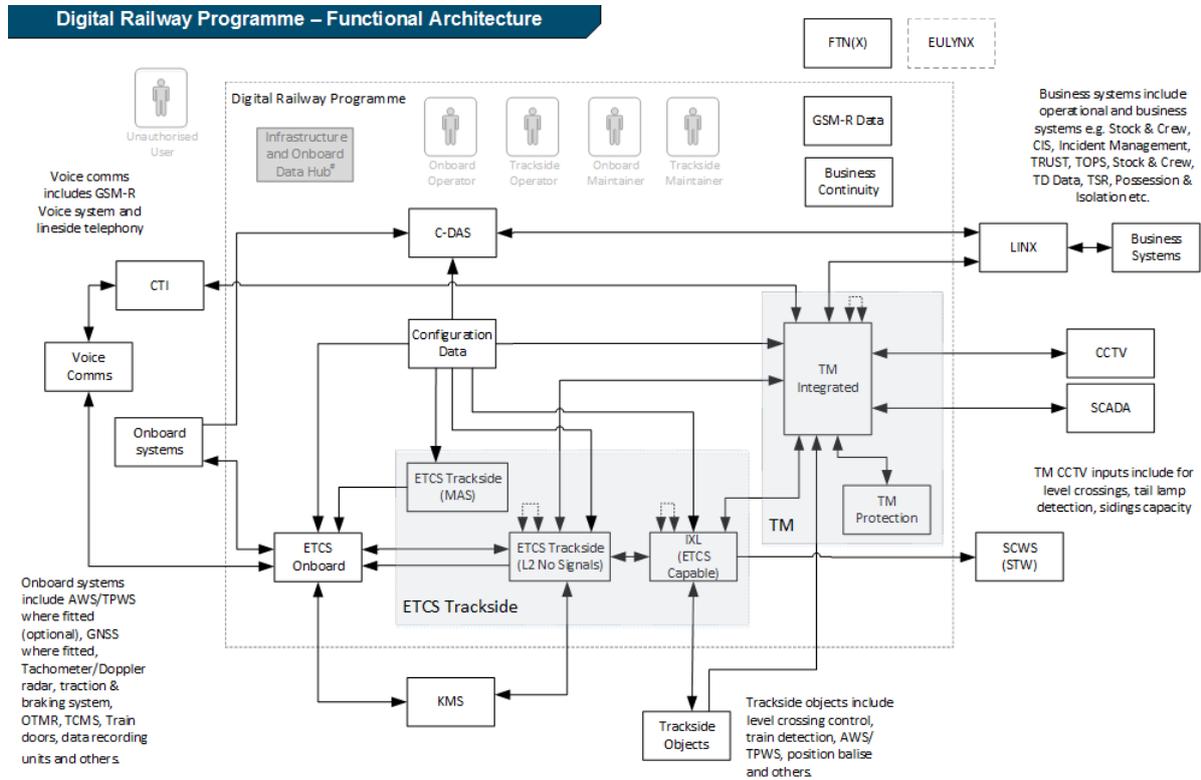


Figure C: DR System of Systems architecture as taken from [RD5]

For the purposes of operational readiness, we need to consider each part of the architecture that people will have a direct routine interaction with in order to perform their day to day jobs. For operations staff this is defined as:

- ETCS Onboard
- Integrated Traffic Management
- C-DAS Onboard

For maintenance staff, update and configuration activities, the architecture in its entirety must be considered. This is shown in Figure D: User Interactions.

System	ETCS Trackside	TM Integrated	ETCS Onboard	C-DAS
Actors Required to Interact	Trackside Maintainer	Trackside Operator Trackside Maintainer	Onboard Operator Onboard Maintainer	Onboard Operator Onboard Maintainer Trackside Maintainer

Figure D: User Interactions

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## 4. Operational Readiness Requirements Elicitation Process

### 4.1 Process Objectives & Themes

To achieve the desired outcome for a set of operational readiness requirements for the DR System of Systems (SoS), DR must be able to demonstrate through documentary evidence that the following objectives have been achieved:

1. The needs of the day to day users of the system have been identified and all reasonably predictable operating scenarios have been considered – including:
  - i. Normal - The railway's normal operating state when not subject to an operating incident of any kind
  - ii. Abnormal - An unforeseen or unplanned event which does not have life-threatening or extreme loss implications
  - iii. Degraded - A planned or unplanned reduction in the ability of the DR SoS to operate in its normal manner.
  - iv. Emergency - Any failures of the Dr SoS that may cause immediate risk of extreme loss.
2. Where changes to existing processes, procedures, training or rules are required, either as a result of changing user behaviours, changes to the way the users interact with the operational railway, or in order to mitigate hazards.
3. That where the Digital Railway Basis of Design [RD3] indicates that a process is required, a corresponding requirement has been produced.
4. Ensure uniformity of system application across deployment projects by minimising or where possible eliminating differences in processes and procedures for maintenance and operations.
5. Eliminate or reduce the risk of all procedurally controlled activities during operations and maintenance.
6. Take account of Lessons Learnt from existing deployments, when developing operational readiness requirements.
7. Be conscious of, and incorporate the key themes of Safety, reducing the reliance on human intervention, and Human Factors, to ensure that the DR SoS is fit for purpose.

The process outlined in this document has been developed to facilitate the achievement of these objectives.

### 4.2 Outputs

The primary output will be a set of generic Operational Readiness Requirements, applicable to the DR SoS configuration. Each requirement will describe what is required to be in place in order that the users and maintainers of the system are capable and have all the required support to operate and maintain the system safely and efficiently on go-live.

The requirement set will include:

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- Rule Requirements - These are requirements that will describe the required changes to the National Rule Book, or other operational documentation as a result of the implementation of the DR SoS.
- Process Requirements - These are requirements that will describe the changes to existing, or generation of new operational and maintenance processes as a result of the implementation of DR SoS.
- Training Requirements - These are requirements that will identify changes to existing, or generation of new training as a result of implementation of DR SoS.
- Maintainability Requirements - These are requirements that will identify changes to existing, or generation of new maintenance regimes for DR SoS and propose asset accountability and boundaries for DR SoS. The requirements will also consider access to assets, and any other Maintenance and Support arrangements.

Additionally and where necessary as result of the work, outputs will form an action for DRP to consider changes to the ongoing Customer Requirement Specifications and/or requesting an update to the integrated Concept of Operations. This will be required in areas where existing system functionality is not deemed sufficient from an operations, maintenance or safety point of view.

### 4.3 Process Map

This section provides a diagrammatic overview of the process to be used to develop the Operational Readiness Requirements.

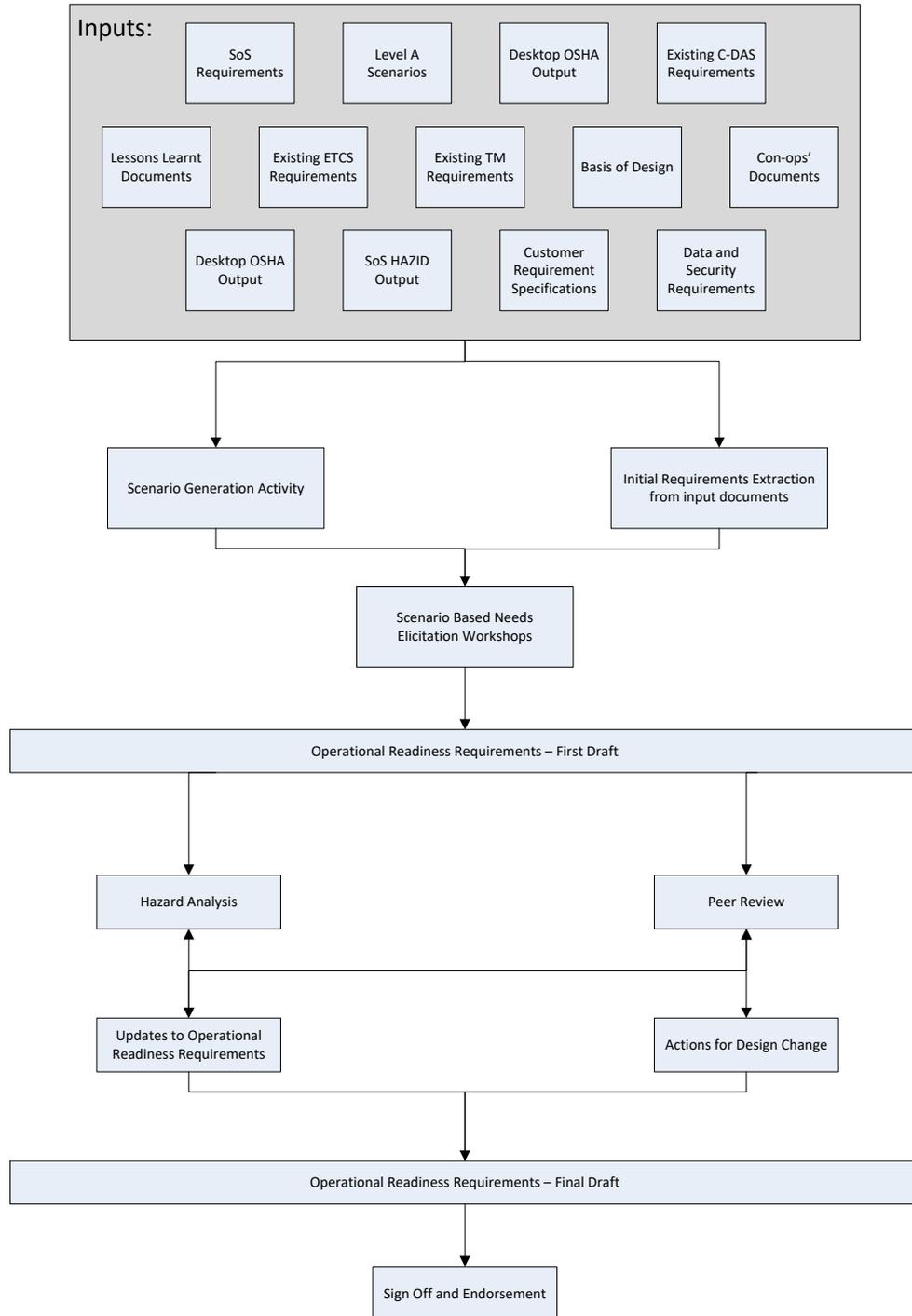


Figure E: Process Map

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#### 4.4 Stage 1: Initial Requirements Extraction & Scenario Generation

In the first stage work needs to be undertaken to identify existing requirements relating to operational readiness from each of the source requirements documents. Once this is complete, areas can be identified where existing requirements either don't exist, or are inadequate. This activity will define the scale of the work required in Stage two. This activity will provide an initial requirement set, consisting wholly of requirements drawn from the source documents.

Concurrently, during stage one, Operational Scenarios will be developed, by mapping the existing Level A scenarios onto normal, degraded, abnormal, and emergency scenarios. These scenarios can then be used to structure the workshops in Stage Two.

Also at this stage, the outstanding issues for ETCS degraded working will be addressed, as the solutions will be required in subsequent stages of this plan.

**Outputs at this stage:** Operational Readiness Requirements Extraction (Internal only).

#### 4.5 Stage 2: Requirements Elicitation Workshops

In this stage, a series of operational scenarios workshops (including maintenance) will be held to examine the areas identified in stage one as requiring further work. The objectives of these workshops are to confirm the validity of the requirements already identified, and where requirements are missing, to generate new requirements. This will be particularly important where requirements have previously been generated as part of the development of an individual system, as it will be important to check the validity of these requirements in the SoS context.

The operational scenarios workshops will be structured around considering the whole SoS system, rather than individual sub-systems.(i.e. ETCS, C-DAS & TM Integrated) in isolation. This approach helps to ensure that the requirements generated, whether at an SoS or System level co-exist with one another and optimise the resulting operational readiness requirements.

These workshops will require significant stakeholder involvement by operational, maintenance and engineering specialists from across the industry in both the planning and delivery phases of the workshops. Relevant stakeholders with the appropriate field of expertise will be invited to participate in each workshop based on the scenarios being considered at the specific session.

**Outputs at this stage:** Workshop output documentation.

#### 4.6 Stage 3: Produce First draft of requirements

Outputs generated in the first two stages will drive the generation of a first draft set of operational readiness requirements, including requirement text, rationale, and guidance. The requirements will be produced in a format suitable for importing into DOORS.

There will be a need to maintain contact with the stakeholders on an ad hoc basis during this activity to help close out points of uncertainty in order to produce a robust draft requirement set.

**Outputs at this stage:** Operational Readiness Requirements first draft.

#### 4.7 Stage 4a: Peer Review and Update Requirements

The completed first draft requirement set will be peer reviewed. The objective of this is to determine whether the requirements have reached the required level of quality, both in terms of the technical detail and the meaning of each requirement is sufficiently clear. It is envisaged that the peer reviewers for each topic will be drawn from the following groups:

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- SR&I Team
- Industry Signalling Operations Specialists
- Industry Maintenance Specialists
- Industry Stakeholders
- Human Factors Specialists
- Technical Specialist on each subsystem
- Other technical specialists where required

A fixed period will be allowed for the reviewing activity; the exact duration will be determined as the programme is developed but it is anticipated that this will be ten working days.

All comments received during the peer review will be recorded and responses provided by the author. Agreement of the responses will be obtained from the originators of the comments. A record of all comments and agreed responses will be maintained. The requirement set will be updated to reflect the agreed responses to the comments. This activity will occur concurrently with Stage 4b.

Additionally, at this stage, where existing system functionality is not deemed sufficient this will be noted as an action for DRP to consider change to the DRP Customer Requirement Specifications and/or requesting an updated to the integrated Concept of Operations.

**Outputs at this stage:** Updated Operational Readiness Requirements incorporating comments received during peer review.

#### 4.8 Stage 4b: Hazard Analysis

A Hazard Analysis must be undertaken in line with what is described in the Operational Safety Hazard Analysis section of [RD6]. The control of hazards will be managed in line with the DRP Hazard Management Plan [RD7].

Additionally, at this stage, where existing system functionality is not deemed sufficient this will be noted as an action for DRP to consider changes to the DRP Customer Requirement Specifications and/or requesting an updated to the integrated Concept of Operations.

**Outputs at this stage:** Updated Operational Readiness Requirements incorporating comments received during peer review.

#### 4.9 Stage 5: Incorporation of requirement set into existing CRS documents & Publication

Once the requirement set has reached a clear and stable reference point, and has undergone a peer review, hazard analysis and any required changes have been made; the requirements within the set can be incorporated into the existing DRP CRS documents.

**Outputs at this stage:** Final Operational Readiness Requirements document.

#### 4.10 Stage 6: Endorsement of Requirement Set

Stage Seven covers the formal endorsement of the requirement set by the Head of System Requirements & Integration, which signifies the end of the Operational Readiness Requirement Process. At the conclusion of stage six, the requirement set can be used by DRP in their development of Engineering Rules, National standards working with the deployment projects and the industry stakeholders. This will ensure that the operational readiness changes the industry needs will be delivered ready for the deployment of digital technologies.

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**Outputs at this stage:** Endorsed Operational Readiness Requirements.

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