



Digital Railway – GB Generic Customer Requirements Specification for ETCS Onboard

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Version History

Issue	Date	Comments
0.1	23/02/18	First draft
0.2	02/03/18	Updated to review comments from Jonathan Evans
0.3	21/03/18	Updated to review comments
0.4	23/03/18	Updated to review comments
0.5	02/04/18	Updated to DOORS output and for final review
0.6	10/04/18	Consolidated draft for acceptance
1.0	24/04/18	First formal issue
2.0	23/11/18	Updated to new CRS template (v0.7) and incorporated requirements agreed at the Change Review meeting on 12/11/2018
2.1	14/03/19	Updated to include generic wording changes plus the SR&I change panels for CRS #3 and CRS #4. Issued for review.
3.0	26/03/19	Disclaimer amended, formatting corrected and formally issued

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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 specification to align it to the relevant Concepts of Operations documents which have been updated in parallel. Final assurance of the complete alignment of this specification with the relevant industry-endorsed Concepts of Operations will be achieved in a later version.
2. Alignment with SoS hazard identification activity to identify requirements that should be safety tagged.
3. For a list of open points please refer to section 4.1.
4. This document has been submitted for Level 3 assurance in accordance with the System Management Plan [RD17]. A response has been received with 1 Category 1 comment(s) (i.e. there is an issue associated with a fundamental concern, error, omission or question that has a direct bearing on the acceptability of the document). Use/choice by deployment projects to use metric or imperial measurements. A response has been made to address the comments which is reflected in this version of the document. However, confirmation has not yet been received that these responses are considered to be satisfactory which may result in amendments to a future revision 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.

1. For a list of assumptions please refer to section 0.

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. For a list of dependencies please refer to section 4.3.

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ABBREVIATIONS, ACRONYMS AND DEFINITIONS

Abbreviations are explained in full on first use within this document. A comprehensive list of abbreviations and definitions is contained in the Glossary [R11]

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REFERENCES

Dependent References

An update to one of these references requires a review to identify any potential need for an update to this document.

RD1	Operational Concept for ERTMS, RSSB-ERTMS-OC, v2.0, December 2014
RD2	Digital Railway – GB Generic System of Systems Customer Requirements Specification, 153819-NWR-SPE-ESE-000003, Version 5.0
RD3	Digital Railway – European Train Control System (ETCS) Onboard System Definition, 153821-NWR-REP-ESE-000005, Version 3.0
RD4	Digital Railway – GB Generic Interface Requirements Specification, 153821-NWR-SPE-ESE-000013, Version 3.0
RD5	Technical Standard for Interoperability (CCS), Commission Regulation (EU) 2016/919
RD6	Digital Railway – Integration Fundamentals Handbook, 153819-NWR-GDN-MPM-000001, Version 1.0
RD7	Digital Railway – Customer Requirements Specification – Requirements Management Plan – 153819-NWR-PLN-ESE-000006, Issue 2.0
RD8	Removed
RD9	Digital Railway Customer Requirements Deployment Policy, 153819-NWR-SPE-ESE-000002, Version 1.0
RD10	Digital Railway Customer Requirements Change Control Process, 153819-NWR-SPE-ESE-000004, Version 1.0
RD11	GB Generic Customer Requirements Specification for Traffic Management Systems (TMS), 153821-NWR-SPE-ESE-000011, Version 3.0
RD12	GB Generic Customer Requirements Specification for Connected Driver Advisory System (C-DAS), 153821-NWR-SPE-ESE-000010, Version 3.0
RD13	GB Generic Customer Requirements Specification for ETCS Trackside, 153821-NWR-SPE-ESE-000007, Version 3.0
RD14	GB Generic Customer Requirements Specification for Operations & Maintenance, 153819-NWR-PLN-ESE-000014, Version 2.0
RD15	GB Generic Interface Requirements Specification, 153821-NWR-SPE-ESE-000013, Version 3.0
RD16	Digital Railway Requirements – ETCS Onboard, 153821-NWR-SPE-ESE-000017, Version 1.0

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RD17 Digital Railway Programme – System Management Plan, 153819-NWR-PLN-MPM-000002, Version 8.0

Informative References

These references have no material bearing on the content of this document but are referenced within it. Unless otherwise specified, the latest version should be used.

- RI1 Digital Railway – Glossary of Terms & Abbreviations, 153819-NWR-SPE-ESE-000001
- RI2 Digital Railway – Introduction to the Requirements Structure, 153819-NWR-PLN-ESE-000012

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1 Introduction

1.1 Purpose

The purpose of this document is to set out the generic Customer Requirements that apply to the ETCS Onboard when it is deployed on the GB railway network. These generic Customer Requirements are intended as a baseline to ensure that the ETCS Onboard solutions adopted on any individual deployment project will integrate and be compatible across route boundaries and with the generic ETCS Trackside, using ETCS Onboard in the context of the System of Systems Generic Baseline Architecture [RD3].

All deployment projects involving the ETCS Onboard will use this document as a basis of their requirements suite for this system.

1.2 Scope

This document provides the generic Customer Requirements for the ETCS Onboard, including functional, non-functional and process requirements. The ETCS Onboard comprises the European Vital Computer (EVC), Driver Machine Interface (DMI), balise readers, GSM-R data radio, odometry devices, juridical recorder (JRU and interfaces to other train systems. It is aligned to the existing ERTMS Concept of Operations [RD1], which describes how the GB railway is intended to operate where this system is deployed. (This document may be subject to further update to ensure that it fully aligns with the new ETCS Concept of Operations – see exclusions).

Acceptable solutions to the Customer Requirements in this document are constrained by the Digital Railway Requirements contained within the 'Digital Railway Requirements – ETCS Onboard' [RD16], and deployment projects must comply with both the Customer and Digital Railway Requirements. The relationship between the Customer Requirements and other elements of the overall Requirements Structure for Digital Railway is explained further within the Introduction to the Requirements Structure document [RI2].

This system will not exist in isolation on the railway and will need to interact with a variety of other systems, which may include both existing systems and Digital Railway systems. The relevant extract of the baseline System of Systems architecture is set out in the Figure 1. This document supports, and is reliant upon, the GB Generic System of Systems Customer Requirements Specification [RD2].

Where they relate to the European Train Control System (ETCS), the Requirements sit within a legal framework of the European Interoperability Directive (translated into UK legislation via the Railway Interoperability Regulations) and the Technical Standards for Interoperability of which the Control, Command and Signalling (CCS) TSI is relevant to this document [RD5]. The CCS TSI requires the European Union Agency for Rail (ERA) to publish error corrections on a periodic basis and it is assumed, for the purposes of this document, that the deployment of ETCS will be to set of specifications #3 as detailed in the appendix of the CCS TSI and the latest Technical Opinion issued in accordance with Article 10 of the CCS TSI.

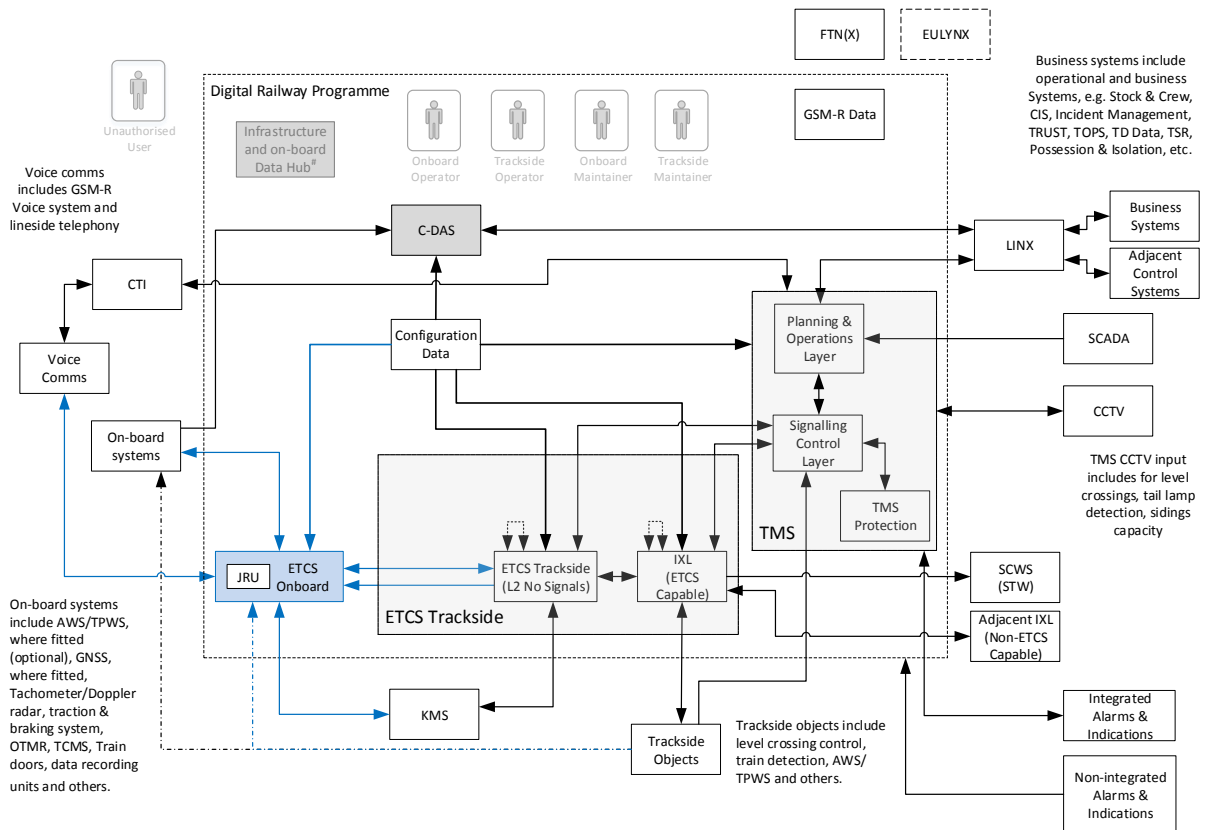


Figure 1 – The SOS Architecture

The system boundary for the ETCS Onboard is set out in the European Train Control System (ETCS) Onboard System Definition, [RD3], which also describes the generic environmental context in which the system is expected to exist.

This document does not set out interface requirements between the ETCS Onboard and other systems as these are separately documented in the Interface Requirements Specification [RD4]. The successful implementation of the ETCS Onboard is reliant upon compliance with the relevant interface requirements in [RD4].

This document does not contain details of any deployment project-specific requirements. These may be found in deployment project-specific documentation, which is subordinate to this document.

Section 2.2 of this document sets out how a deployment project will identify which of the requirements in this document are relevant to its needs.

This CRS forms part of a suite of requirements specifications and therefore for a complete understanding of Digital Railway operation, should be read in conjunction with the CRSs and IRS for:

- System of Systems [RD2]
- Traffic Management System [RD11]
- ETCS Trackside [RD13]
- Connected Driver Advisory [RD12]
- Operations and Maintenance Readiness [RD14]
- Interface Requirements Specification [RD15]

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The acceptance criteria applicable to the Customer Requirements within this document will be documented separately in a Verification and Validation Matrix.

1.3 Business Need for this Specification

There are many potential solutions for implementing the Digital Railway Strategy and realising the visions set out in the Concepts of Operations [RD1] (note: exclusion 1).

However, if left totally unconstrained, there is a risk that different deployment projects could independently generate solutions that were sufficiently different as to create technical or operational compatibility issues at the railway system boundaries. Compatibility issues of this nature would inhibit the GB railway's ability to meet the objectives set out above and must, therefore, be avoided. Examples of compatibility issues could include:

- One project's Traffic Management System solution being unable to provide a second project's Traffic Management System solution with all the information needed for effective management of train services crossing the boundary between them; or,
- a train driver having to learn and apply different sets of operational procedures relating to the same underlying system across different geographical areas.

The generic Customer Requirements are intended to promote the development of technically, operationally and environmentally compatible solutions, which are safe and secure, and which could be deployed across the GB rail network in order to maximise the benefits which the industry can reap from the adoption of digital technologies.

This document is one of a suite of generic Customer Requirements Specifications for the core CCS systems and is sub ordinate to the generic System of Systems Customer Requirements Specification [RD2].

The generic Customer Requirements for the ETCS Onboard are intended to be complementary to the Command, Control and Signalling Technical Specification for Interoperability (CCS TSI) [RD5] and associated Baseline 3 ETCS specifications detailed in Table A2.3 issued by the European Union Agency for Railways. Every effort has been made to avoid conflict with the CCS TSI and Baseline 3 specifications but, in case of conflict, the CCS TSI (including the UK specific cases) and Baseline 3 specifications take precedence.

1.4 Document Maintenance

This document is owned by the DR Programme's Head of System Requirements and Integration (SR&I).

Updates may be instigated, as necessary, as indicated below:

- To incorporate any changes arising from industry consultation
- To incorporate any lessons learnt
- In response to formal change proposals
- In response to changing constraints in applicable legislation, standards or associated Digital Railway Requirements
- In response to changes in objectives set out in the Business Requirements or Concept of Operations
- At the direction of the Head of SR&I as the document owner
- When the disbanding of the SR&I team is planned, in order to transfer ownership of the document, if it is still necessary, to an alternative organisation

Potential proposers of change include, but are not limited to, duty holders, deployment project teams, suppliers and asset owners.

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Proposed changes to the requirements within this document will be managed in accordance with the Requirements Change Control Process [RD10].

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2 Application of this Specification

2.1 Requirements Presentation

All requirements are in the following form:

<p><i>Safety</i></p> <p>Requirement text.</p> <p style="text-align: right;">Unique-Identifier</p>
--

Source: Identifies where the requirement originated.

Status: Normative or Application-Specific. (See Section 2.2).

Rationale: Shows applicability of the requirement, including why the requirement exists, who it is for, what industry benefit could be achieved, what the constraints are, and any other essential detail. Note: Cross-referencing should be used to avoid over-lengthy rationales.

Guidance: Supplementary information to support Requirement interpretation and satisfaction.

2.1.1 Safety Tagged Requirement

Where a requirement has been associated with a Safety Measure, this is identified and referenced to the hazard record number. (Note, the requirements marked as *Safety* in this document arise from the work on the Reference Design, hazard identification for the SoS is outstanding. For this reason, hazard identities are not included in this version).

2.1.2 Unique Requirement Identifier

Each requirement has been identified uniquely. The requirement numbers have been generated within the DOORS database, which means that the requirement numbering may be neither sequential nor gap-free.

2.1.3 Requirement Status

Each requirement within this document is identified as either 'Normative' or 'Application-Specific'.

Normative requirements are mandatory for all deployment projects.

Application-specific requirements are mandatory for all deployment projects on which the issue or subject addressed by the requirement occurs.

2.2 Identification of Applicable Requirements

The generic Customer Requirements in this document are intended to cover the vast majority of circumstances that will be encountered on the GB rail network. However, not all circumstances will be encountered by every deployment project and some deployment projects may encounter local issues that are not covered by the generic Customer Requirements Specification.

Consequently, each deployment project must ensure that it establishes and documents the appropriate set of Customer Requirements for its circumstances. The process for doing so is outlined in the Digital Railway Integration Fundamentals Handbook [RD6] and in detail for

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deployment projects within the DRP Customer Requirements Deployment Policy [RD9] and may be summarised as follows:

1. The starting point is the generic Customer Requirements Specification (i.e. this document for the ETCS Onboard).
2. All normative requirements within the generic Customer Requirements Specification are applicable to every deployment project.
3. Any application-specific requirements which relate to circumstances that do not apply to the deployment project in question may be deleted and marked as 'not required' along with the rationale for their non-inclusion.
4. New Customer Requirements may be generated to address local issues which only apply to a specific deployment project but are not covered in the generic Customer Requirements Specification, provided that they do not compromise the achievement of cross-boundary compatible solutions. The rationale for the locally-developed requirement will be captured along with the requirement, including any reasons for not following a particular path.

Appendix A contains a template which deployment projects can populate to indicate which of the application-specific requirements are applicable to their particular circumstances (step 3 above).

Appendix B contains a template which deployment projects can use to record any new customer requirements they generate for their particular circumstances (step 4 above).

Note that a deployment project is not permitted to:

1. amend the wording of an existing generic Customer Requirement; or,
2. replace an existing generic Customer Requirement with a differently worded requirement relating to the same issue.

These restrictions are necessary to prevent the risk of generating a project-specific set of Customer Requirements that may not achieve a cross-boundary compatible solution.

If a deployment project considers that the wording or status of an existing Customer Requirement is incorrect, or wishes to add a new requirement to cover any local issues which apply to the deployment project but are not covered in the generic Customer Requirements Specification, then this should be raised with the System Authority via the change request process for consideration at a national level, as described in section 1.4 and in detail in the Digital Railway Customer Requirements Change Control Process [RD10].

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3 Customer Requirements

3.1 Functional Requirements

This section sets out functional requirements that define, where applicable, what the ETCS Onboard system needs to accomplish.

3.1.1 Principles

The ETCS Onboard System Version shall be version 2.1. CRS-ETCS(O)-2

Source: Interface Definition Document

Status: Normative

Rationale: To achieve technical interoperability on the GB rail network where 'Baseline 3 Release 2, system version 2.1' has been chosen for deployment as part of the ETCS Trackside.

Guidance: Adopting System Version 2.1 makes a number of features mandatory that will be beneficial for Railway Undertakings (RUs) in the whole-life management of the ETCS Onboard, including Online Key Management (Subset-137) and Offline Key Management (Subset-114).

The ETCS Onboard shall support all train operations defined in the Deployment Concept of Operations. CRS-ETCS(O)-3

Source: Concept of Operations

Status: Normative

Rationale: To enable all types of ETCS-fitted train operation that are required to be undertaken on ETCS-fitted infrastructure, and at the boundaries of an ETCS area.

Guidance: Generally, this is expected to include multiple working, banking, tandem working, dead hauling, and shunting.

The Cold Movement Detection System shall be fitted and remain functional for an agreed period of time when the ETCS Onboard is in No Power (NP). CRS-ETCS(O)-11

Source: Subset-026, System of Systems

Status: Normative

Rationale: To enable the ETCS Onboard to retain a known position when it is left in an unpowered state, thus permitting a fully supervised rail vehicle movement with higher level safety and performance at the earliest possible opportunity when power is restored to the ETCS Onboard.

Guidance: The time needs to support the operational needs of the rail vehicle if it is determined that NP may extend beyond the 72 hours minimum specified in Subset-026.

The duration when Cold Movement Detection is available in NP needs to be

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established based on the likely service pattern of the rail vehicle and on-board traction system.

The ETCS Onboard shall be simple to operate. CRS-ETCS(O)-27

Source: Good practice

Status: Normative

Rationale: To minimise the training time required for operating staff and reduce the risk of errors in operating the ETCS Onboard.

Guidance: The quality and usability of the training materials and tools will support the satisfaction of this requirement.

The ETCS Onboard shall be capable of supporting future functionality developments. CRS-ETCS(O)-29

Source: DR development needs

Status: Normative

Rationale: The solution should not place unnecessary constraints on the ability to accommodate future needs.

Guidance: Examples of upgrades: ETCS Level 3, Automatic Train Operation (ATO) over ETCS, etc.

3.1.2 Driveability

When operating in a Level NTC, the ETCS Onboard shall not prevent the operation of the Class B system associated with that Level NTC. CRS-ETCS(O)-19

Source: EOSS, ENTOSS

Status: Normative

Rationale: GB Class B systems are required to be unsuppressed when a rail vehicle is operating in Level NTC SH in order to comply with the Railway Safety Regulations 1999.

Guidance: Where a Specific Transmission Module (STM) is used, the CCS TSI details the suppression of the Class B protection system if operating in Level NTC SH (Shunting). Therefore, although the use of a fully compliant STM is permissible, the GB preference is for a non-STM interface to enable compliance with the Railway Safety Regulations 1999 to be achieved by allowing the Class B system to be fully operational.

3.1.3 Degraded Operations

The driver shall be presented with vehicle speed information whilst the ETCS Onboard system is isolated. CRS-ETCS(O)-10

Source: Concept of Operations

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Status: Normative

Rationale: To allow the driver to drive safely.

Guidance: This could be achieved through the provision of an auxiliary speed display, use of the train management system, or maintaining the display on the ETCS DMI through a separate input or other means.

The driver shall be able to isolate each ETCS Onboard independently without affecting any other on-board system.

CRS-ETCS(O)-15

Source: Concept of Operations

Status: Normative

Rationale: The non-availability of the ETCS Onboard functionality should not prevent the normal operation of the rail vehicle in areas where the rail vehicle can be operated in accordance with a lineside signalling system and Class B Train Protection systems.

Guidance: When the ETCS is Isolated, the controls and indications relevant to operation with the lineside signalling system available to the driver will include:

- Current rail vehicle speed information
- Class B system status information
- Controls to acknowledge warnings and interventions from Class B systems.

Consideration should also be given to methods/process of de-isolation.

It shall be possible for the driver to reset the supervising ETCS Onboard system from the active cab independently of any ETCS Isolation methodology or other on-vehicle systems.

CRS-ETCS(O)-16

Source: Industry best practice

Status: Normative

Rationale: To provide more flexibility for rail vehicle preparation while reducing the impact on performance. This will avoid resetting other sub-systems (e.g. GSM-R Voice cab radio) while not required.

Guidance: Drivers should be able to reset the ETCS manually (i.e. Mode transition from Standby (SB) to NP and back to SB) without affecting other sub-systems, such as GSM-R Voice, in the driving cab. The reset facility should only require the driver to undertake a single action to operate it. This capability will save time as the driver will not need to restart all other sub-systems not impacted by a failure of the ETCS Onboard or one of its components, such as the ETCS DMI.

The ETCS Onboard shall support independent isolation of Class B systems.

CRS-ETCS(O)-18

Source: Industry best practice

Status: Application-Specific

Rationale: To enable safe management of degraded modes and reduce impact on performance.

Guidance: Drivers will need to be aware of the status of each Class B system in order to be able to apply appropriate operational rules regarding operations outside of

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ETCS areas. The required facilities for each Class B system in terms of isolation and override must be available when the Class B system is integrated with the ETCS Onboard.

3.1.4 Other

The ETCS Onboard shall remain operational when the rail vehicle experiences fluctuations and temporary losses of the primary power supply.

CRS-ETCS(O)-4

Source: Industry best practice

Status: Normative

Rationale: To maintain the conditions required for normal rail vehicle operations.

Guidance: For each vehicle application, the deployment project needs to consider the power system as a whole and maintain continuity of operation. For example, the ETCS Onboard could be powered for a short period via a secondary power source on the rail vehicle (usually, a battery). Situations in which a temporary loss of primary power supply may be experienced during which the ETCS Onboard should remain operational include, but are not limited to, when an electric rail vehicle passes through a neutral section or over a conductor rail gap, when an electric rail vehicle is performing 'high-speed coasting' with pantograph lowered due to damaged Overhead Line Equipment, or when diesel engines are being started.

The ETCS Onboard shall not prevent an ETCS-fitted On Track Machine (OTM) from performing its designated engineering tasks when operating in a possession area.

CRS-ETCS(O)-17

Source: Concept of Operations, Locomotive & Passenger Rolling Stock (LOC&PAS) TSI

Status: Application-Specific

Rationale: To enable safe access to possession areas and maintain OTM engineering task capabilities.

Guidance: OTMs are used in different modes: working mode, transport mode as a self-propelling vehicle, transport mode as a hauled vehicle (source: LOC & PAS TSI). The ETCS Onboard should not constrain the operation of the OTM when in working mode.

3.2 Non-Functional Requirements

This section sets out non-functional requirements, such as those relating to performance, reliability, security, competence and training which, where applicable, place constraints on the design or implementation of the ETCS Onboard. Non-functional requirements which apply generically across all systems within the System of Systems are recorded in the GB Generic System of Systems Customer Requirements Specification [RD2] and are not duplicated here.

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3.2.1 System Performance

The cab mobilisation time of a rail vehicle fitted with the ETCS Onboard shall be no longer than the cab mobilisation time of the equivalent rail vehicle with relevant GB Class B on-board systems prior to the installation of the ETCS Onboard.

CRS-ETCS(O)-6

Source: Concept of Operations

Status: Normative

Rationale: To avoid degradation of performance for ETCS railway operations compared to those with GB Class B on-board systems.

Guidance: Timetables, crew schedules, and crew relief points may be planned around the cab mobilisation time using GB Class B on-board systems. If the cab mobilisation time for a train fitted with an ETCS Onboard were to be greater than that for a train fitted with GB Class B on-board systems, these planning assumptions could be invalidated, and the timetable rendered unachievable using existing resources. This requirement also includes time / interfaces to allow any Class B or other system to mobilise.

The ETCS Onboard shall not degrade the braking systems of the rail vehicle.

CRS-ETCS(O)-21

Source: GM/RT 2045

Status: Normative

Rationale: To comply with UK National Notified Technical Rules, where a UK specific case is known.

The ETCS Onboard shall not adversely affect the Route Availability of the rail vehicle being fitted.

CRS-ETCS(O)-28

Source: Industry best practice

Status: Normative

Rationale: To enable the vehicle to continue to operate on all parts of the network over which it can currently operate.

3.2.2 Reliability, Availability, Maintainability (RAM)

The ETCS Onboard shall safely integrate with all interfacing systems.

CRS-ETCS(O)-5

Source: Subset-034, System of Systems

Status: Normative

Rationale: To provide integrated on-board systems that are demonstrably safe.

Guidance: When seeking authorisation for the Placing into Service of an on-board safety system, demonstration of safe integration between the safety system and the vehicle is required.
This takes into account, and is not limited to, interactions with Class B systems plus status information (input and output) transmitted via the Train Interface

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Unit (TIU). Examples of TIU inputs are: Cab detection/status, Sleeping input, Non-leading input, Brake status, etc. Train Interface output is determined by the requirement for safe integration plus any deployment project requirements that can include control of on-train ancillary functions, such as lowering and raising of pantographs, changing of power supply sources, the opening/closing of traction line breakers, and inhibition of various special brakes, for example, eddy current, regenerative, etc.

3.2.3 Safety

The ETCS Onboard shall not degrade the safety of staff, passengers and the public. CRS-ETCS(O)-20

Source: Legislation

Status: Normative

Rationale: The safety of staff, passengers and the public is paramount, and the ETCS Onboard should not degrade their safety over that provided by other, or previously used, systems. The CSM RA details harmonised processes for risk evaluation and assessment and the evidence and documentation produced during the application of these processes.

Guidance: The ETCS Onboard needs to adhere to standard safety legislation, including the application of So Far as is Reasonably Practicable (SFAIRP) principles. Where vehicles operate abroad as well as on the GB rail network, the impact of other legislation must be considered.

3.2.4 Security

The ETCS Onboard shall have robust protection against cyber-attacks, unauthorised access, vandalism and accidental damage. CRS-ETCS(O)-23

Source: Rail Cyber Security Guidance to Industry, Department for Transport, 2016

Status: Normative

Rationale: To avoid the disruption and potential safety hazards that result from loss of system availability either accidentally or via malicious intent.

Guidance: The ETCS Onboard uses open transmission systems integrated into the GB Rail network that may be subject to unauthorised access through various means:

- remotely, via the Internet, or unsecured telecom networks.
- at close hand, through direct contact with infrastructure (e.g. through a USB port).
- locally, through unauthorised access to physical infrastructure, or insider threat (infiltration). Further guidance can be found in BS EN 50159:2010. DR's Security Assurance Document [RD16] outlines good practice.

3.2.5 Information Management

None.

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3.2.6 Ergonomics and Human Factors

The risks of data entry errors by the driver shall be minimised. CRS-ETCS(O)-13

Source: Industry best practice

Status: Application-Specific

Rationale: The ETCS Onboard uses the information provided by the driver to calculate braking curves. These enable safe operation and data entry errors could result in them being compromised.

Guidance: This may be achieved by reducing duplicate entries, automating entry, providing check mechanisms, or other techniques. The ETCS DMI, GSM-R Voice display and Connected Driver Advisory System (C-DAS) may require the same information. Rather than entering the data multiple times, it is better to have a single source of information to avoid the likelihood of errors. Train Running Number (i.e. Headcode) and Driver ID should be entered once by the driver to avoid the potential for discrepancies occurring if entered from different displays.
 Note: Data sharing between on-board systems is not a standard feature of a CCS TSI-compliant ETCS Onboard system.

The ETCS Onboard shall be integrated into the rail vehicle in a way that enables safe and effective interaction between the ETCS Onboard and the user. CRS-ETCS(O)-24

Source: Good practice

Status: Normative

Rationale: To enable the driver and maintenance technicians to access information and controls in a way that supports the safe and effective execution of their tasks.

Guidance: Consideration should be given to the positioning of displays, sound emitters, and controls in locations that are appropriate for the task to be performed, taking account of any other tasks that may be performed by the relevant user either simultaneously or consecutively.

3.2.7 Electromagnetic Compatibility and Environment

The ETCS Onboard shall not adversely affect nor be adversely affected by other systems, either on or off board. CRS-ETCS(O)-22

Source: BS EN 50155:2017

Status: Normative

Rationale: To enable safe integration with the rail vehicle.

Guidance: The ETCS Onboard should not cause any damage to any connected equipment when it does not operate as intended during or after an event/incident. Possible causes of failure are incorrect timing of output signals, overvoltage outside specifications, Electromagnetic Compatibility (EMC), environmental etc.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

The ETCS Onboard installation in the rail vehicle shall not adversely impact the environmental capability of the rail vehicle.

CRS-ETCS(O)-25

Source: BS EN 50125-1:2014, BS EN 50121-3-2:2016

Status: Normative

Rationale: To avoid degradation of environmental capability applicable to the rail vehicle.

Guidance: Rail vehicles should be able to operate satisfactorily after ETCS fitment in the same environmental conditions as they could prior to ETCS fitment. The 'Rolling Stock - Locomotives and Passenger Rolling Stock' Technical Specification for Interoperability (TSI) contains information on the environmental conditions that new build vehicles are expected to cope with. Rail vehicles being retrofitted with ETCS may have been built to cope with a different set of environmental conditions and it may, or may not, be feasible for them to achieve compliance with the environmental conditions specified in the TSI as part of the retro-fitment activity.

3.2.8 Health & Safety

None.

3.2.9 Operational Readiness

None.

3.2.10 Maintenance & Diagnostics

The ETCS Onboard shall inform the driver when an error or failure is detected.

CRS-ETCS(O)-7

Source: System of Systems

Status: Normative

Rationale: To enable the driver to take safe decisions and resume the mission when it is possible to do so.

Guidance: Errors presented to the driver are defined in Subset-026 and the ETCS DMI specification. Subset-026 v3.6.0 #15, Table 69 is relevant when a Class B system exists or is fitted with Specific Transmission Module Form Fit Functional Interface Specification (STM FFFIS) (Subset-035).

The ETCS Onboard shall provide the driver with sufficient tools and information to enable them to understand the status of the ETCS Onboard and the impact of faults.

CRS-ETCS(O)-8

Source: ERA_ERTMS_015560 ETCS Driver Machine Interface v3.6.0

Status: Normative

Rationale: To allow drivers and competent authorised staff easy access to diagnostic and maintenance data and enable them to share it promptly with their maintenance control.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

Guidance: This may be achievable through the ETCS DMI. Diagnostic information is expected to be visual and easy to interpret and will be supported by meaningful maintenance messages explaining the action required to resolve outstanding issues.

The ETCS Onboard shall be able to export diagnostic and maintenance data to a remote maintenance system. CRS-ETCS(O)-14

Source: Industry best practice

Status: Application-Specific

Rationale: To allow monitoring of rail vehicle performance (Remote Condition Monitoring) and enable remote diagnostics.

Guidance: ETCS maintenance and investigations require knowledge of events and data exchanged at each interface to determine responsibilities between Railway Undertakings and Infrastructure Managers. This is in line with the Duty of Co-operation.

The ETCS Onboard shall allow easy recovery from corrective maintenance. CRS-ETCS(O)-26

Source: Performance needs.

Status: Normative

Rationale: ETCS Onboard maintainability needs to allow full operational service to be resumed as soon as reasonably possible, and, where possible, without the need for moving the failed rail vehicle to a maintenance depot.

Guidance: This will be achieved through reliability, self-diagnostics, ease of change, training, and information support, etc. with reduced need to return components to the Original Equipment Manufacturer (OEM) for repair.

3.2.11 Competence and Training

The ETCS Onboard shall support Additional Driver Training Displays. CRS-ETCS(O)-12

Source: Concept of Operations

Status: Application-Specific

Rationale: To allow drivers enough time to familiarise themselves with cab-signalling driving and enable driver instructors to observe the information presented to a driver when monitoring driver performance during training and service conditions.

Guidance: Any suitable output could be provided, allowing a screen to be connected which would also allow recording of the ETCS DMI display. The connection must not allow the additional display to influence the operation of the ETCS DMI.

3.2.12 Whole Life Costs

None.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

3.2.13 Other

None.

3.3 Process Requirements

3.3.1 Target Setting

Projects shall establish the Reliability, Availability and Maintainability (RAM) requirements for the ETCS Onboard.

CRS-ETCS(O)-30

- Source:* ERTMS/ETCS
RAMS Requirements Specification Chapter 2 - RAM, 02S126, v6
- Status:* Normative
- Rationale:* To contribute to closing the Reliability/Availability requirements open point in Annex G of the CCS TSI.
- Guidance:* Projects should consider the requirements outlined in the following documents: 'ERTMS/ETCS RAMS Requirements Specification Chapter 2 – RAM' (ref: 02S126, version 6); and 'National ERTMS Team - ERTMS Reliability Specification' (ref: NR/AM/SA/SPE/00147 Issue: A07).

Projects shall establish the environmental envelope requirements for the ETCS Onboard.

CRS-ETCS(O)-31

- Source:* BS EN 50125-1:2014, BS EN 50155:2017, EEIG 97s066 v5, BS EN 50153:2014+A1:2017
- Status:* Normative
- Rationale:* To protect the environment and prevent hazards that could affect the overall safety of the railway, such as electromagnetic interference and electrical-related hazards.
- Guidance:* Projects should consider the requirements outlined in the following documents: BS EN 50125-1:2014 - Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment'; BS EN 50155:2017 - Railway applications. Rolling stock. Electronic equipment'; 'ERTMS/ETCS Environmental Requirements' (ref: 97s066, version 5); BS EN 50121-3-2:2016 'Railway applications. Electromagnetic compatibility. Rolling stock. Apparatus'; and BS EN 50153:2014+A1:2017 – 'Railway applications - Rolling stock - Protective provisions relating to electrical hazards'. Environmental condition requirements cover: Temperature, Solar radiation, Humidity, Wind and Pressure pulses, Altitude, Water and Precipitation, Pollutants and Contaminants, Mechanical (Shocks, Vibration, Noise, etc.), Electrical, EMC, and Ergonomics. These conditions take into account the whole life of the System, including its transportation and storage. It should be noted that further guidance on compliance to Electromagnetic Compatibility requirements can be found in BS EN 50121, 'Railway applications - Electromagnetic compatibility' Parts 1 to 5.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

Projects shall establish the relevant ergonomic standards to apply to the ETCS Onboard. **CRS-ETCS(O)-32**

Source: BS EN 16186-1:2014

Status: Application-Specific

Rationale: To enable the ETCS Onboard installation to be designed and implemented in a way which will support the driver and maintenance staff engaging with it safely and effectively.

Guidance: Projects should consider the requirements outlined in the following documents:
 BS EN 16186-1:2014 – ‘Railway applications. Driver's cab. Anthropometric data and visibility’;
 BS EN 16186-2:2017 – ‘Railway applications - Driver's cab - Part 2: Integration of displays, controls and indicators’; and
 BS EN 16186-3:2016 – ‘Railway applications. Driver's cab. Design of displays’.

3.3.2 Standards

None.

3.3.3 Engineering Management

None.

3.3.4 Governance and Approvals

The Deployment Project Team shall identify the applicable requirements for the ETCS Onboard from the Digital Railway System Authority's Digital Railway Requirements. **CRS-ETCS(O)-36**

Source: Digital Railway System Authority

Status: Normative

Rationale: To enable the Digital Railway Requirements to be consistently and proportionately applied to GB train fleets.

Guidance: For the ETCS Onboard, the Digital Railway Requirements are mostly contained within the following documents:
 For retro-fittments: ‘ERTMS/ETCS Baseline 3 Onboard Subsystem Requirements: Retrofit’, RIS-0797-CCS
 For new build trains: ‘ERTMS/ETCS Baseline 3 Onboard Subsystem Requirements: New Trains’, RIS-0798-CCS

3.3.5 Other

None.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

4 Associated Information

4.1 Open Points

The open points for this generic Customer Requirements Specification are tabulated in Table 1 below.

Table 1 Open Points

Number	Issue	Description	Identified in Version	Closed in Version
O1	Management of train speed	The GB network currently applies a range of speed profiles and restrictions based on the type of train. The train types do not readily match the information which can be transmitted by ETCS (axle load, cant deficiency, train category). The output of a DR Programme work stream is awaited.	1.0	

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

4.2 Assumptions

The assumptions made in connection with this generic Customer Requirements Specification are tabulated in Table 2 below.

Table 2 Assumptions

Number	Issue	Assumption	Identified in Version	Closed in Version
A1	Metric speed units	It is assumed that ETCS Level 2 operation will be undertaken utilising metric units including: a) entry of metric distances and speeds by drivers, b) display of metric distances and speeds to the driver, c) entry of metric speeds for temporary restrictions by the signaller or others, d) display of metric distances and speeds to the signaller.	1.0	

4.3 Dependencies

The dependencies associated with this generic Customer Requirements Specification are tabulated in Table 3 below.

Table 3 Dependencies

Number	Issue	Dependency
D1	GSM-R Availability	The ETCS Onboard requires communication with the ETCS Trackside and these requirements assume that: a) there will be no radio holes, b) that in the event of loss of safe communications this will be re-established within one retry cycle, c) that at all locations where Start of Mission is planned to occur connection will always be established with no more than one retry.

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

4.4 Constraints

The constraints associated with this generic Customer Requirements Specification are tabulated in Table 4 below.

Table 4 Constraints

Number	Issue	Constraint
		None identified

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

Appendix A APPLICABILITY ASSESSMENT TEMPLATE

A.1 Guidance on Populating the Template

A deployment project wishing to record the results of their applicability assessment should copy this template into a new deployment project-specific document for population.

Insert project name into the relevant box near the top of the template.

For each Application-Specific requirement, insert the word 'Yes' in the 'Applicable' box if the issue or subject addressed by the requirement is relevant to the deployment project in question.

If the issue or subject addressed by an Application-Specific requirement is not relevant to the deployment project in question, insert the word 'No' in the 'Applicable' box.

It is not permissible to change the Applicability status of Normative requirements as these are mandatory on all deployment projects.

A.2 Feedback

Deployment projects are requested to send copies of their populated Applicability Assessment Templates to the Digital Railway System Requirements and Integration team. This will enable the team to assess the value that the industry is deriving from the Application-Specific requirements and will support future improvements to the generic Customer Requirements Specification.

A.3 Template

Deployment Project Applicability Assessment of GB Generic Interface Requirements Specification			
Deployment Project Name			
Requirement ID	Interface	Status	Applicable

Reference	153821-NWR-SPE-ESE-000008
Issue/Ver:	3.0
Date:	26/03/2019

Appendix B NEW CUSTOMER REQUIREMENTS TEMPLATE

B.1 Guidance on Populating the Template

A deployment project wishing to draft new Customer Requirements should copy this template into a new deployment project-specific document for population. New requirements should not be added to Appendix B of the generic Customer Requirements Specification itself.

Text in italics prefixed 'GN' forms guidance for the user of this template.

Further guidance may be found in the Customer Requirements Specifications' Requirements Management Plan [RD7].

B.2 Feedback

Deployment projects are requested to send copies of any additional Customer Requirements generated to the Digital Railway System Requirements and Integration team. This will enable the team to identify future improvements to the generic Customer Requirements Specification.

B.3 Template

<p><i>Safety</i></p> <p>The requirement text goes here.</p> <p><i>GN: It must be a clear, concise and unambiguous statement of what is required. It must include the word 'shall'.</i></p> <p style="text-align: right;">Unique-Identifier</p>

Source: Source statement goes here.

GN: This is a statement which identifies where the requirement originated to provide traceability of the requirement's origin. This could include references to a Concept of Operations, System of Systems Customer Requirements Specification, hazard record, or other document that sets out a high-level expression of what this system needs to achieve.

Status: Normative or Application-Specific.

GN: This will be 'Application-Specific' unless this template is being used to propose a change to the generic Customer Requirements Specification in accordance with the change process set out in section <1.x>.

Rationale: Rationale statement goes here.

GN: This explains why the requirement is needed and its application, including why the requirement exists, who it is for, what industry benefit could be achieved, what the constraints are, and any other essential detail. Cross-referencing to other documentation to avoid the need for lengthy explanations is acceptable.

Reference	153821-NWR-SPE-ESE- 000008
Issue/Ver:	3.0
Date:	26/03/2019

Guidance: Guidance statement goes here.

GN: The guidance statement contains any supplementary information that may be of value in assisting with the interpretation of the requirement or in determining how the requirement could be satisfied.

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