MEETING:	Control Command and Signalling (CCS) Rolling Stock (RST) Traffic Operation and Management (TOM)
DATE:	30/06/2022 15/07/2022 28/06/2022
SUBJECT:	5-year review of GEGN8578 Issue 3 - Guidance on the Use of On-Train Satellite Positioning Technology Based Locator for Railway Applications
SPONSOR:	Ged Neacy
AUTHOR:	Jianhong Jin

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1. Purpose of the paper

1.1 This paper sets out the assessment of the five-year review of GEGN8578 Issue 3 - Guidance on the Use of On-Train Satellite Positioning Technology Based Locator for Railway Applications. It seeks Standards Committee approval/support on the recommendation and way forward.

2. Background

2.1 GEGN8578 issue three provides guidance on good practice for the specification, selection, implementation and installation of on-train satellite positioning technology based equipment (the locator), in support of applications requiring train Position, Velocity and Time.

2.2 GEGN8578 issue three was developed for use by train operators, train builders, infrastructure managers, and suppliers with an interest in applying satellite positioning technology for railway applications.

2.3 The guidance is applicable to all Global Navigation Satellite System (GNSS) based positioning technologies. GNSS includes the Global Positioning System (GPS), GLONASS (the system of the Russian Federation) and GALILEO (the European global satellite navigation system to provide Europe independence and greater robustness).

2.4 The scope of this document is the on-train arrangements that include the locator and its external interfaces.

2.5 GEGN8578 issue three was largely based on the output of research project RSSB research project T892 (2013).

2.6 The following were the key changes in GEGN8578 issue three:

a) the title was changed to align with the scope of the document;

b) Figure 1 was updated to illustrate locator interfaces to applications both on-board and at the trackside, and to clarify the scope of the guidance note;

c) the definition of the locator and its classifications was made clearer;

d) the guidance on the capability of the Class B locator was updated;

e) Appendix D of issue two (on standard interface) was incorporated as Part 4;

f) additional guidance on defining requirements, choice and procurement of the locator

were included in Part 5 of the document;

g) an overview of location dependent applications within the Great Britain (GB) railway was added;

h) example applications were provided in the Appendix A to illustrate the use of a locator; and

i) the technology overview in Appendix A of issue two was removed.

3. Impacts of the document(s) following publication/entering into force

3.1 The initial feedback from the stakeholders on the impact of the GEGN8578 was that the document provides a useful source of information and that an update is needed to reflect the current implementations and changes in technologies.

3.2 Consideration has been given to the following during the review:

a Business case for change – The document was developed before the RSSB business case for change process was established however the main objective of helping the industry to apply good practice on the use of locator for railway applications has been achieved. The guidance provided inputs to industry working streams such as Network Rail (NR) C-DAS programme and the Rail Delivery Group (RDG) national GPS gateway project.

b Deviations - Not applicable.

c Current projects or proposals being processed – There are no current projects or proposals that impact on GEGN8578. The need for a research project to inform the update of the GEGN8578 is being considered. The potential research project could bring up to date the catalogue of location dependent applications on the railway identified by the previous RSSB research project T892 (2013). The research would also support the understanding of current/future reliance on GNSS based solution and explore good practices on resilient PNT.

d Limited change release –There have been no limited change releases.

e Amendments and clarifications – There are no amendments and clarifications.

f Enquiries – There were two enquiries received since the last review.

i) An enquiry from the Positioning, Navigation and Timing (PNT) Lead from the Knowledge Transfer Network (KTN) was received in 2018, requesting the listing of GEGN8578 issue three on the Royal Institution of Navigation (RIN) website. A list of GNSS guidelines was compiled by RIN in its capacity as co-chair of the Cabinet Office PNT Technical Group. GEGN8578 has since been included in the list.

ii) The second enquiry was received from DfT in September 2021. The DfT enquiry stated “We’ve recently read an RSSB publication GE/GN8578 Guidance on the Use of On-Train Satellite Positioning Technology Based 2015 where a single locator approach was advocated. The guidance is very thorough and contains section on service coverage, accuracy and integrity and interference. Although the publication is not mandatory requirement we would be interested to know how much compliance there is with the guidance and if this has led to any improvements.” Following subsequent discussions, the inquirer has registered to be included in the consultation of the document and would support RSSB in looking at the overall reliance of the rail network on PNT.

g Research projects –

i) Technical demonstrator 2.4 (TD 2.4) 'fail-safe train positioning' is one of the Shift2Rail Innovation Programme 2 (IP2) technical demonstrators (TDs) that aims to develop a fail-safe, multi-sensor train positioning system applying GNSS technology to the current ERTMS/ETCS core by using new or existing on-board sensors. The project published system requirements specifications for virtual balises and standalone applications in December 2018 and December 2019 respectively. The concepts are yet to be further tested. A more detailed review is needed to assess the impact on GEGN8578. The potential changes to the document include updating the list of the signalling and control applications in Table 1, and the quality-of-service parameters in section 3.4.

ii) There are other related European projects such as Certifiable Localisation Unit with GNSS in the Railway Environment (CLUG), led by SNCF, which aimed at solutions for ERTMS L3, and moving block. One of the tasks was to define a Train Localisation On-Board Unit (TLOBU) architecture using data fusion of multiple sensors to support safety critical applications. It recommended combined terrestrial and space dissemination for improved integrity, availability, and continuity. The impact of the findings from this project on guidance in GEGN8578 needs to be reviewed. Another recent EU project entitled "System for vehicle-infrastructure Interaction Assets health status monitoring" (SIA) referenced GEN8578 in Deliverable D2.1 (res(2019)4710471) as one of the source documents for user requirements.

iii) The NR Target 190+ programme includes a localisation workstream that provides a Location strategy (T190/DES/RPT/020). The document describes strategic solutions for locating vehicle, people and moveable objects on the railway. It aims to align the solutions to the future CCS environment and to achieve Rail Industry Readiness Level (RIRL) 6, which includes the proof of concept and technology demonstrators. The impact needs to be reviewed when the deliverables from Targe190+ programme are made available.

h Changes in regulations – There are no changes in regulations that have direct impact to this document.

i Changes in technology – The document needs to reflect the developments of Galileo and Beidou in recent years, for example the existing guidance on the use of multiple constellations refer to GLONASS only. The deployment of these new systems also means that the guidance on locator external interfaces (Part 4) needs to be reviewed for completeness. In addition, an update to the guidance in G 5.3 'Procurement of GNSS equipment' is also needed to reflect the current receiver market.

j National Technical Specification Notices (NTSNs) and European standards – There are currently no changes to NTSNs that have direct impact on this document. However, future updates to the CCS NTSN will need to be assessed for any impact on this document, especially when ERTMS change request (CR1368) is included in a future version of CCS TSI. CR1368, prepared by European GNSS Agency (GSA), European Space Agency (ESA), European Satellite Services Provider (ESSP) and ERTMS Users Group (EUG), proposes the inclusion of the adoption of GNSS within fail-safe train localisation in ERTMS.

k Published list of NTRs – There is no impact on current published NTRs.

l Any other observations

i) The Blackett review report (2018) examined the reliance of existing critical national

infrastructure (CNI) on GNSS. It recognized the potential threats of using GNSS in the railway environment and the need to develop resilience owing to the increasing use of GNSS in supporting safety-critical applications. It refers to GEGN8578 as being of high quality, and that "The Department for Transport, Network Rail and RSSB should determine whether the guidance can be formalised into a mandatory standard. This would result in cost savings, due to more effective and common-practice use of location information across the rail network." The report was discussed at the Future Communications and Positioning Systems Advisory Group (FCP&S AG) meeting in May 2018, and as there were no safety impact identified at that time for potential reliance on GNSS signal (secondary systems were in-place), no changes were deemed necessary.

ii) The recent enquiry from DfT re-emphasis the need to understand the reliance of the railway on PNT. The existing guidance on vulnerability of GNSS solutions could be expanded if the overall reliance on GNSS based solutions (current and future) are understood and a unified approach proposed.

iii) Following the UK's exit from the European Union (EU), the UK no longer participates in the European satellite navigation programmes Galileo and European Geostationary Navigation Overlay Service (EGNOS). This means the UK will not be able to use Galileo for defence or critical national infrastructure and will not have access to encrypted Galileo Public Regulated Service or EGNOS Safety of Life service. Alternative ways of providing resilient PNT needs to be considered including using existing geostationary satellites to provide some complementary signals. The guidance in GEGE8578 issue three relating to Galileo and EGNOS needs to be updated to reflect these.

iv) The Open CCS On-board Reference Architecture (OCORA) initiative (founding members are NS Groep N.V., SNCF, DB, SBB and ÖBB) published Release R1 of the specifications of the OCORA architecture in December 2021. OCORA aims to reduce life-cycle costs by establishing a CCS on-board architecture that is 'modular, upgradeable, interchangeable, reliable and secure.' It worked with ERMTS User Group (EUG) Localisation Working Group (LWG) on the requirements for on-board location related interfaces. The location of the train is provided by a 'Vehicle Locator'. The principle of the general architecture of this locator aligns with the 'Locator' concept promoted in GEGN8678. The main difference is the specific emphasis on the GNSS receiver in the latter and the need to include more non-GNSS sensors such as optical sensors.

4. Discussion

4.1 Review assessment

4.1.1 The guidance has been referenced by industry work streams including C-DAS and National GPS gateway programme. The document has been listed on the RIN website and featured in the Blackett review report and EU project SIA.

4.1.2 There are Shift2Rail projects being carried out on the use of the 'Locator' for safety critical applications. The impact from these projects will need to be reviewed when the findings are delivered. The next phase of TD 2.4 is expected to complete on 31 May 2023.

4.1.3 GEGN8578 will be aligned with any potential changes to the CCS NTSN resulting from the ERTMS change request CR1368 which is expected to be incorporated in the CCS TSI in 2027 (CLUG D3.4). Updates to GEGN8578 will also need to be aligned with the outcomes from other initiatives relating to on-board location interfaces such as OCORA, and the

work by EUG LWG and Target 190+.

4.1.4 Although the principle of the guidance (such as promoting the single locator approach with standard interfaces) stays applicable, the changes in technology and implementations mean there is need to update the guidance to reflect these changes.

4.1.5 FC&PS AG has been supportive of the initial recommendations including the idea of a research project as identified in 3c). Involvement of FC&PS AG members will be sort to support in the updating of the guidance.

4.1.6 A proposal for a new RSSB research project is being discussed to inform the update of the guidance by considering:

a) the DfT's query regarding GB railway's reliance on GNSS based PNT solutions, and good practices on resilient PNT.

b) the current and potential implementations of GNSS based on-train locator that support related industry strategies including T190+ localisation work stream;

c) the impact of the development of Galileo and other constellations and that the UK is no longer participate in Galileo and EGNOS; and

d) the impact of the development in GNSS receiver technology, augmentations and other non-GNSS sensors to the guidance.

4.1.7 It is proposed to carry out an industry consultation to gain a better understanding of the current use of the guidance including the implementation of the single 'Locator' approach, and to gather information on the current and potential GNSS based applications.

4.1.8 There is a need to update the guidance however it is not urgent as the principle of the guidance stays appliable, and the changes to the CCS NTSN relating to CR1368 are not expected until 2027. Owing to the lack of information available to use to update GEGN8578, it is proposed to work with key stakeholders to agree a research proposal to consider the topics set out in 4.1.6. It is therefore proposed that the update of GEGN8578 be deferred until further information from the research project is available.

5. Recommendations

5.1 The CCS Standard Committee is asked to:

a DISCUSS the five-year review assessment and the following proposed recommendation:

- Action required:

  Defer the update of GEGN8578 until further information is available.

  Develop a proposal for a research project to inform the update of GEGN8578.

  Carry out consultation with industry – identify additional stakeholders to consult

b APPROVE:

The recommendation including consultation with industry.

5.2 The RST Standard Committee is asked to:

c DISCUSS the five-year review assessment and the following proposed recommendation:

- Action required:

Defer the update of GEGN8578 until further information is available.

Develop a proposal for a research project to inform the update of GEGN8578.Carry out consultation with industry – identify additional stakeholders to consult

d SUPPORT:

The recommendation including consultation with industry.

5.3 The TOM Standard Committee is asked to:

e DISCUSS the five-year review assessment and the following proposed recommendation:

i Action required:

Defer the update of GEGN8578 until further information is available.

Develop a proposal for a research project to inform the update of GEGN8578.

Carry out consultation with industry – identify additional stakeholders to consult

f SUPPORT:

The recommendation including consultation with industry.

References

Ares(2019)4710471	System for vehicle-infrastructure Interaction Assets health status monitoring, D2.1, End user requirements of SIA and validation plan, GSA, 19/07/2019
Blackett review report (2018)	Satellite-derived Time and Position: A Study of Critical Dependencies, Government Office for Science, 2018
CLUG D3.4 (2021)	GNSS Augmentation Needs for Rail, EUSPA, 2021
OCORA-BWS03-010	Open CCS On-board Reference Architecture, OCORA Release R1, 29/11/2021
T190/DES/RPT/020	Generic Design – GB Localisation Strategy, Network Rail Research and Development, 28/06/2021
T892 RSSB (2013)	Data analysis for a cost-effective GPS-based locator with simple augmentations

RSSB completion: [do not delete]

Lead Standards Committee	*Meeting date*	*Recommendation approved*	*Minute numbers*		*Next review date*
			Pre-consultation review	*Post-consultation review*	
Control command and Signalling	30/06/2022				