



GRANT AGREEMENT

Project 101180124 — VICE4RAIL

PREAMBLE

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and

on the other part,

1. 'the coordinator':

RETE FERROVIARIA ITALIANA (RFI), PIC 999434360, established in PIAZZA DELLA CROCE ROSSA 1, ROMA 00161, Italy,

and the following other beneficiaries, if they sign their 'accession form' (see Annex 3 and Article 40):

2. **CONSORZIO UNIVERSITA INDUSTRIA - LABORATORI DI RADIOCOMUNICAZIONI (RDL)**, PIC 999585971, established in CORSO D ITALIA 19, ROMA 00198, Italy,

3. **ITALCERTIFER SOCIETA PER AZIONI (ITCF)**, PIC 996654340, established in LARGO FRATELLI ALINARI 4, FLORENCE 50123, Italy,

4. **BUREAU VERITAS ITALIA SPA (BVI)**, PIC 913300300, established in VIALE MONZA 347, MILANO 20126, Italy,

5. **CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS (CEDEX)**, PIC 999455312, established in ALFONSO XII 3, MADRID 28014, Spain,

6. **UNIVERZITA PARDUBICE (UPCE)**, PIC 999453663, established in Studentska 95, PARDUBICE 532 10, Czechia,

7. **UNIVERSITE GUSTAVE EIFFEL (UNI EIFFEL)**, PIC 897556521, established in 5 BOULEVARD DESCARTES CAMPUS DE MARNE-LA-VALLE, MARNE-LA-VALLEE 77454, France,

8. **SOGEI-SOCIETA GENERALE D'INFORMATICA SPA (SGI)**, PIC 949108723, established in VIA MARIO CARUCCI 99, ROMA 00143, Italy,

9. SOCIETE NATIONALE SNCF (SNCF), PIC 999941767, established in 2 PLACE AUX ETOILES, ST DENIS 93200, France,

Unless otherwise specified, references to ‘beneficiary’ or ‘beneficiaries’ include the coordinator and affiliated entities (if any).

If only one beneficiary signs the grant agreement (‘mono-beneficiary grant’), all provisions referring to the ‘coordinator’ or the ‘beneficiaries’ will be considered — mutatis mutandis — as referring to the beneficiary.

The parties referred to above have agreed to enter into the Agreement.

By signing the Agreement and the accession forms, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

The Agreement is composed of:

Preamble

Terms and Conditions (including Data Sheet)

Annex 1 Description of the action¹

Annex 2 Estimated budget for the action

Annex 2a Additional information on unit costs and contributions (if applicable)

Annex 3 Accession forms (if applicable)²

Annex 3a Declaration on joint and several liability of affiliated entities (if applicable)³

Annex 4 Model for the financial statements

Annex 5 Specific rules (if applicable)

¹ Template published on [Portal Reference Documents](#).

² Template published on [Portal Reference Documents](#).

³ Template published on [Portal Reference Documents](#).

TERMS AND CONDITIONS

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DATA SHEET

1. General data

Project summary:

Project summary
<p>VICE4RAIL aims to accelerate the adoption of EGNSS for deploying efficient, resilient, and competitive ERTMS solutions. Focus is on the development of a certification and standardization process for the use of EGNSS, closing the gaps for rail safety critical applications and converging towards a pan-European EGNSS-based solution for ERTMS and its global roll-out. The starting point is the use of EGNOS V2 and the Balise virtualisation – as indicated by the European Parliament directive on July 2021 – opening the way for further applications based on the absolute train positioning and EGNOS V3. Two major developments will be undertaken: identification of suitable certification procedures compliant with the CENELEC norms and realization of a Hybrid Virtualized Testing Certification Environment based on the zero-on-site testing paradigm with the construction of a dedicated testing facility on a RFI's railway lines where GNSS-based multisensor positioning solutions can be evaluated and certified in operational scenarios. This unique testing environment will be connected with the ERTMS accredited laboratory of CEDEX to assess the end-to-end performance of the ERTMS chain with GNSS-based positioning devices in operational scenarios. Behaviour of the system under GNSS signals that include faults very rare and difficult to experience field but with a potential high impact on safety, can be evaluated avoiding extensive and not exhaustive field tests. VICE4RAIL will exploit the synergies with the Pilot Line Novara – Rho funded by RFI to integrate GNSS positioning into the ERTMS and the Shift2Rail GATE4Rail project that introduced the zero-on-field virtual testing for GNSS. Furthermore, thanks to SNCF, CEDEX, RFI and SOGEL a liaison will be established with the Europe's Rail R2DATO project to complement their on-going activities and sharing results and assets and with the RTCM SC 134 Special Committee that is completing the standardization process for GNSS receivers for rail.</p>

Keywords:

- Global Satellite Navigation System (GNSS) / Services & Applications
- Certification and standardization for the use of EGNSS; ERTMS solutions; EGNOS V3

Project number: 101180124

Project name: Hybrid Virtualized Testing for Certification of EGNSS in Railway Train Positioning

Project acronym: VICE4RAIL

Call: HORIZON-EUSPA-2023-SPACE

Topic: HORIZON-EUSPA-2023-SPACE-01-42

Type of action: HORIZON Innovation Actions

Granting authority: European Union Agency for the Space Programme

Grant managed through EU Funding & Tenders Portal: Yes (eGrants)

Project starting date: first day of the month following the entry into force date

Project end date: starting date + months of duration

Project duration: 36 months

Consortium agreement: Yes

2. Participants

List of participants:

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
1	COO	RFI	RETE FERROVIARIA ITALIANA	IT	999434360	599 500.00	419 650.00
2	BEN	RDL	CONSORZIO UNIVERSITA INDUSTRIA - LABORATORI DI RADIOCOMUNICAZION I	IT	999585971	668 750.00	668 750.00

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
3	BEN	ITCF	ITALCERTIFER SOCIETA PER AZIONI	IT	996654340	191 040.00	133 728.00
4	BEN	BVI	BUREAU VERITAS ITALIA SPA	IT	913300300	220 375.00	154 262.50
5	BEN	CEDEX	CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS	ES	999455312	221 600.00	221 600.00
6	BEN	UPCE	UNIVERZITA PARDUBICE	CZ	999453663	183 900.00	183 900.00
7	BEN	UNI EIFFEL	UNIVERSITE GUSTAVE EIFFEL	FR	897556521	193 075.00	193 075.00
8	BEN	SGI	SOGEL-SOCIETA GENERALE D'INFORMATICA SPA	IT	949108723	295 000.00	206 500.00
9	BEN	SNCF	SOCIETE NATIONALE SNCF	FR	999941767	23 550.00	16 485.00
9.1	AE	SNCF VOYAGEURS	SNCF VOYAGEURS	FR	893626081	99 196.25	69 437.38
Total						2 695 986.25	2 267 387.88

Coordinator:

- RETE FERROVIARIA ITALIANA (RFI)

3. Grant**Maximum grant amount, total estimated eligible costs and contributions and funding rate:**

Total eligible costs (BEN and AE)	Funding rate (%)	Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
2 695 986.25	100, 70	2 267 387.88	2 267 387.88

Grant form: Budget-based**Grant mode:** Action grant**Budget categories/activity types:**

- A. Personnel costs
 - A.1 Employees, A.2 Natural persons under direct contract, A.3 Seconded persons
 - A.4 SME owners and natural person beneficiaries
 - A.6 Personnel unit cost
- B. Subcontracting costs
- C. Purchase costs
 - C.1 Travel and subsistence
 - C.2 Equipment
 - C.3 Other goods, works and services
- D. Other cost categories
 - D.2 Internally invoiced goods and services
- E. Indirect costs

Cost eligibility options:

- In-kind contributions eligible costs
- Parental leave

- Project-based supplementary payments
- Average personnel costs (unit cost according to usual cost accounting practices)
- Country restrictions for subcontracting costs
- Limitation for subcontracting
- Travel and subsistence:
 - Travel: Actual costs
 - Accommodation: Actual costs
 - Subsistence: Actual costs
- Equipment: depreciation only
- Indirect cost flat-rate: 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any)
- VAT: Yes
- Country restrictions for eligible costs
- Other ineligible costs

Budget flexibility: Yes (no flexibility cap)

4. Reporting, payments and recoveries

4.1 Continuous reporting (art 21)

Deliverables: see Funding & Tenders Portal Continuous Reporting tool

4.2 Periodic reporting and payments

Reporting and payment schedule (art 21, 22):

Reporting					Payments	
Reporting periods			Type	Deadline	Type	Deadline (time to pay)
RP No	Month from	Month to				
					Initial prefinancing	30 days from entry into force/10 days before starting date – whichever is the latest
					Interim payment	90 days from receiving periodic report
1	1	18	Periodic report	60 days after end of reporting period	Final payment	90 days from receiving periodic report
2	19	36	Periodic report	60 days after end of reporting period		

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	1 813 910.30

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (113 369.39), retained from the initial prefinancing

Restrictions on distribution of initial prefinancing: The prefinancing may be distributed only if the minimum number of beneficiaries set out in the call conditions (if any) have acceded to the Agreement and only to beneficiaries that have acceded.

Interim payment ceiling (if any): 90% of the maximum grant amount

Exception for revenues: Yes

No-profit rule: Yes

Late payment interest: ECB + 3.5%

Bank account for payments:

IT64A0306905000100000014925 BCITITMM

Conversion into euros: Double conversion

Reporting language: Language of the Agreement

4.3 Certificates (art 24):

Certificates on the financial statements (CFS):

Conditions:

Schedule: only at final payment, if threshold is reached

Standard threshold (beneficiary-level):

- financial statement: requested EU contribution to costs \geq EUR 430 000.00

Special threshold for beneficiaries with a systems and process audit(see Article 24): financial statement: requested EU contribution to costs \geq EUR 725 000.00

4.4 Recoveries (art 22)**First-line liability for recoveries:**

Beneficiary termination: Beneficiary concerned

Final payment: Each beneficiary for their own debt

After final payment: Beneficiary concerned

Joint and several liability for enforced recoveries (in case of non-payment):

Individual financial responsibility: Each beneficiary is liable only for its own debts (and those of its affiliated entities, if any)

Joint and several liability of affiliated entities — n/a

5. Consequences of non-compliance, applicable law & dispute settlement forum

Suspension and termination:

Additional suspension grounds (art 31)

Additional termination grounds (art 32)

Applicable law (art 43):

Standard applicable law regime: EU law + law of Belgium

Dispute settlement forum (art 43):

Standard dispute settlement forum:

EU beneficiaries: EU General Court + EU Court of Justice (on appeal)

Non-EU beneficiaries: Courts of Brussels, Belgium (unless an international agreement provides for the enforceability of EU court judgements)

6. Other

Specific rules (Annex 5): Yes

Standard time-limits after project end:

Confidentiality (for X years after final payment): 5

Record-keeping (for X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

Reviews (up to X years after final payment): 2

Audits (up to X years after final payment): 2

Extension of findings from other grants to this grant (no later than X years after final payment): 2

Impact evaluation (up to X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and terms and conditions applicable to the grant awarded for the implementation of the action set out in Chapter 2.

ARTICLE 2 — DEFINITIONS

For the purpose of this Agreement, the following definitions apply:

Actions — The project which is being funded in the context of this Agreement.

Grant — The grant awarded in the context of this Agreement.

EU grants — Grants awarded by EU institutions, bodies, offices or agencies (including EU executive agencies, EU regulatory agencies, EDA, joint undertakings, etc.).

Participants — Entities participating in the action as beneficiaries, affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties.

Beneficiaries (BEN) — The signatories of this Agreement (either directly or through an accession form).

Affiliated entities (AE) — Entities affiliated to a beneficiary within the meaning of Article 187 of EU Financial Regulation 2018/1046⁴ which participate in the action with similar rights and obligations as the beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions).

Associated partners (AP) — Entities which participate in the action, but without the right to charge costs or claim contributions.

Purchases — Contracts for goods, works or services needed to carry out the action (e.g. equipment, consumables and supplies) but which are not part of the action tasks (see Annex 1).

Subcontracting — Contracts for goods, works or services that are part of the action tasks (see Annex 1).

In-kind contributions — In-kind contributions within the meaning of Article 2(36) of EU Financial

⁴ For the definition, see Article 187 Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 ('EU Financial Regulation') (OJ L 193, 30.7.2018, p. 1): "**affiliated entities** [are]:

- (a) entities that form a sole beneficiary [(i.e. where an entity is formed of several entities that satisfy the criteria for being awarded a grant, including where the entity is specifically established for the purpose of implementing an action to be financed by a grant)];
- (b) entities that satisfy the eligibility criteria and that do not fall within one of the situations referred to in Article 136(1) and 141(1) and that have a link with the beneficiary, in particular a legal or capital link, which is neither limited to the action nor established for the sole purpose of its implementation".

Regulation 2018/1046, i.e. non-financial resources made available free of charge by third parties.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371⁵ and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995⁶, as well as any other wrongful or criminal deception intended to result in financial or personal gain.

Irregularities — Any type of breach (regulatory or contractual) which could impact the EU financial interests, including irregularities within the meaning of Article 1(2) of EU Regulation 2988/95⁷.

Grave professional misconduct — Any type of unacceptable or improper behaviour in exercising one's profession, especially by employees, including grave professional misconduct within the meaning of Article 136(1)(c) of EU Financial Regulation 2018/1046.

Applicable EU, international and national law — Any legal acts or other (binding or non-binding) rules and guidance in the area concerned.

Portal — EU Funding & Tenders Portal; electronic portal and exchange system managed by the European Commission and used by itself and other EU institutions, bodies, offices or agencies for the management of their funding programmes (grants, procurements, prizes, etc.).

CHAPTER 2 ACTION

ARTICLE 3 — ACTION

The grant is awarded for the action **101180124 — VICE4RAIL** ('action'), as described in Annex 1.

ARTICLE 4 — DURATION AND STARTING DATE

The duration and the starting date of the action are set out in the Data Sheet (see Point 1).

CHAPTER 3 GRANT

ARTICLE 5 — GRANT

5.1 Form of grant

The grant is an action grant⁸ which takes the form of a budget-based mixed actual cost grant (i.e. a

⁵ Directive (EU) 2017/1371 of the European Parliament and of the Council of 5 July 2017 on the fight against fraud to the Union's financial interests by means of criminal law (OJ L 198, 28.7.2017, p. 29).

⁶ OJ C 316, 27.11.1995, p. 48.

⁷ Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

⁸ For the definition, see Article 180(2)(a) EU Financial Regulation 2018/1046: '**action grant**' means an EU grant to finance "an action intended to help achieve a Union policy objective".

grant based on actual costs incurred, but which may also include other forms of funding, such as unit costs or contributions, flat-rate costs or contributions, lump sum costs or contributions or financing not linked to costs).

5.2 Maximum grant amount

The maximum grant amount is set out in the Data Sheet (see Point 3) and in the estimated budget (Annex 2).

5.3 Funding rate

The funding rate for costs is 100% of the eligible costs for beneficiaries that are non-profit legal entities⁹ and 70% of the eligible costs for beneficiaries that are profit legal entities.

Contributions are not subject to any funding rate.

5.4 Estimated budget, budget categories and forms of funding

The estimated budget for the action is set out in Annex 2.

It contains the estimated eligible costs and contributions for the action, broken down by participant and budget category.

Annex 2 also shows the types of costs and contributions (forms of funding)¹⁰ to be used for each budget category.

If unit costs or contributions are used, the details on the calculation will be explained in Annex 2a.

5.5 Budget flexibility

The budget breakdown may be adjusted — without an amendment (see Article 39) — by transfers (between participants and budget categories), as long as this does not imply any substantive or important change to the description of the action in Annex 1.

However:

- changes to the budget category for volunteers (if used) always require an amendment
- changes to budget categories with lump sums costs or contributions (if used; including financing not linked to costs) always require an amendment
- changes to budget categories with higher funding rates or budget ceilings (if used) always require an amendment
- addition of amounts for subcontracts not provided for in Annex 1 either require an amendment or simplified approval in accordance with Article 6.2

⁹ For the definition, see Article XX of the Horizon Europe Framework Programme and Rules for Participation Regulation (EU) XXX: ‘**non-profit legal entity**’ means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

¹⁰ See Article 125 EU Financial Regulation 2018/1046.

- other changes require an amendment or simplified approval, if specifically provided for in Article 6.2
- flexibility caps: not applicable.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS AND CONTRIBUTIONS

In order to be eligible, costs and contributions must meet the **eligibility** conditions set out in this Article.

6.1 General eligibility conditions

The **general eligibility conditions** are the following:

(a) for actual costs:

- (i) they must be actually incurred by the beneficiary
- (ii) they must be incurred in the period set out in Article 4 (with the exception of costs relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)
- (iii) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2
- (iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation
- (v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices
- (vi) they must comply with the applicable national law on taxes, labour and social security and
- (vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency

(b) for unit costs or contributions (if any):

- (i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2
- (ii) the units must:
 - be actually used or produced by the beneficiary in the period set out in Article 4 (with the exception of units relating to the submission of the final periodic report, which may be used or produced afterwards; see Article 21)
 - be necessary for the implementation of the action and
- (iii) the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 20)

(c) for flat-rate costs or contributions (if any):

- (i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2
- (ii) the costs or contributions to which the flat-rate is applied must:
 - be eligible
 - relate to the period set out in Article 4 (with the exception of costs or contributions relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)

(d) for lump sum costs or contributions (if any):

- (i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2
- (ii) the work must be properly implemented by the beneficiary in accordance with Annex 1
- (iii) the deliverables/outputs must be achieved in the period set out in Article 4 (with the exception of deliverables/outputs relating to the submission of the final periodic report, which may be achieved afterwards; see Article 21)

(e) for unit, flat-rate or lump sum costs or contributions according to usual cost accounting practices (if any):

- (i) they must fulfil the general eligibility conditions for the type of cost concerned
- (ii) the cost accounting practices must be applied in a consistent manner, based on objective criteria, regardless of the source of funding

(f) for financing not linked to costs (if any): the results must be achieved or the conditions must be fulfilled as described in Annex 1.

In addition, for direct cost categories (e.g. personnel, travel & subsistence, subcontracting and other direct costs) only costs that are directly linked to the action implementation and can therefore be attributed to it directly are eligible. They must not include any indirect costs (i.e. costs that are only indirectly linked to the action, e.g. via cost drivers).

In-kind contributions provided by third parties free of charge may be declared as eligible direct costs by the beneficiaries which use them (under the same conditions as if they were their own, provided that they concern only direct costs and that the third parties and their in-kind contributions are set out in Annex 1 (or approved ex post in the periodic report, if their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; ‘simplified approval procedure’).

6.2 Specific eligibility conditions for each budget category

For each budget category, the **specific eligibility conditions** are as follows:

Direct costs

A. Personnel costs

A.1 Costs for employees (or equivalent) are eligible as personnel costs if they fulfil the general eligibility conditions and are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action.

They must be limited to salaries (including net payments during parental leave), social security contributions, taxes and other costs linked to the remuneration, if they arise from national law or the employment contract (or equivalent appointing act) and be calculated on the basis of the costs actually incurred, in accordance with the following method:

{daily rate for the person
multiplied by
number of day-equivalents worked on the action (rounded up or down to the nearest half-day)}.

The daily rate must be calculated as:

{annual personnel costs for the person
divided by
215}.

The number of day-equivalents declared for a person must be identifiable and verifiable (see Article 20).

The actual time spent on parental leave by a person assigned to the action may be deducted from the 215 days indicated in the above formula.

The total number of day-equivalents declared in EU grants, for a person for a year, cannot be higher than 215, minus time spent on parental leave (if any).

For personnel which receives supplementary payments for work in projects (project-based remuneration), the personnel costs must be calculated at a rate which:

- corresponds to the actual remuneration costs paid by the beneficiary for the time worked by the person in the action over the reporting period
- does not exceed the remuneration costs paid by the beneficiary for work in similar projects funded by national schemes ('national projects reference')
- is defined based on objective criteria allowing to determine the amount to which the person is entitled

and

- reflects the usual practice of the beneficiary to pay consistently bonuses or supplementary payments for work in projects funded by national schemes.

The national projects reference is the remuneration defined in national law, collective labour agreement or written internal rules of the beneficiary applicable to work in projects funded by national schemes.

If there is no such national law, collective labour agreement or written internal rules or if the project-



based remuneration is not based on objective criteria, the national project reference will be the average remuneration of the person in the last full calendar year covered by the reporting period, excluding remuneration paid for work in EU actions.

If the beneficiary uses average personnel costs (unit cost according to usual cost accounting practices), the personnel costs must fulfil the general eligibility conditions for such unit costs and the daily rate must be calculated:

- using the actual personnel costs recorded in the beneficiary's accounts and excluding any costs which are ineligible or already included in other budget categories; the actual personnel costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

A.2 and A.3 Costs for natural persons working under a direct contract other than an employment contract and costs for **seconded persons by a third party against payment** are also eligible as personnel costs, if they are assigned to the action, fulfil the general eligibility conditions and:

- (a) work under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed) and
- (b) the result of the work belongs to the beneficiary (unless agreed otherwise).

They must be calculated on the basis of a rate which corresponds to the costs actually incurred for the direct contract or secondment and must not be significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.4 The work of **SME owners** for the action (i.e. owners of beneficiaries that are small and medium-sized enterprises¹¹ not receiving a salary) or **natural person beneficiaries** (i.e. beneficiaries that are natural persons not receiving a salary) may be declared as personnel costs, if they fulfil the general eligibility conditions and are calculated as unit costs in accordance with the method set out in Annex 2a.

A.6 For **beneficiaries with personnel unit cost**, the personnel costs under categories A.1-A.4 must be declared as unit cost and are eligible, if they fulfil the general eligibility conditions, are calculated as unit costs in accordance with the method set out in Annex 2a and comply with the conditions set out in Points A.1-A.4 for the underlying types of costs (personnel).

¹¹ For the definition, see Commission Recommendation 2003/361/EC: micro, small or medium-sized enterprise (SME) are enterprises

- engaged in an economic activity, irrespective of their legal form (including, in particular, self-employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity) and
- employing fewer than 250 persons (expressed in 'annual working units' as defined in Article 5 of the Recommendation) and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.

B. Subcontracting costs

Subcontracting costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible, if they are calculated on the basis of the costs actually incurred, fulfil the general eligibility conditions and are awarded using the beneficiary's usual purchasing practices — provided these ensure subcontracts with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

The beneficiaries must ensure that the subcontracted work is performed in the eligible countries or target countries set out in the call conditions — unless otherwise approved by the granting authority.

Subcontracting may cover only a limited part of the action.

The tasks to be subcontracted and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2 (or may be approved ex post in the periodic report, if the use of subcontracting does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; 'simplified approval procedure').

C. Purchase costs

Purchase costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible if they fulfil the general eligibility conditions and are bought using the beneficiary's usual purchasing practices — provided these ensure purchases with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

C.1 Travel and subsistence

Purchases for **travel, accommodation and subsistence** must be calculated as follows:

- travel: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- accommodation: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- subsistence: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel .

C.2 Equipment

Purchases of **equipment, infrastructure or other assets** used for the action must be declared as depreciation costs, calculated on the basis of the costs actually incurred and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

Only the portion of the costs that corresponds to the rate of actual use for the action during the action duration can be taken into account.

Costs for **renting or leasing** equipment, infrastructure or other assets are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

C.3 Other goods, works and services

Purchases of **other goods, works and services** must be calculated on the basis of the costs actually incurred.

Such goods, works and services include, for instance, consumables and supplies, promotion, dissemination, protection of results, translations, publications, certificates and financial guarantees, if required under the Agreement.

D. Other cost categories

D.2 Internally invoiced goods and services

Costs for internally invoiced goods and services directly used for the action may be declared as unit cost according to usual cost accounting practices, if and as declared eligible in the call conditions, if they fulfil the general eligibility conditions for such unit costs and the amount per unit is calculated:

- using the actual costs for the good or service recorded in the beneficiary's accounts, attributed either by direct measurement or on the basis of cost drivers, and excluding any cost which are ineligible or already included in other budget categories; the actual costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

'Internally invoiced goods and services' means goods or services which are provided within the beneficiary's organisation directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

This cost will not be taken into account for the indirect cost flat-rate.

Indirect costs

E. Indirect costs

Indirect costs will be reimbursed at the flat-rate of 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any).

Contributions

Not applicable

6.3 Ineligible costs and contributions

The following costs or contributions are **ineligible**:

- (a) costs or contributions that do not comply with the conditions set out above (Article 6.1 and 6.2), in particular:
 - (i) costs related to return on capital and dividends paid by a beneficiary
 - (ii) debt and debt service charges
 - (iii) provisions for future losses or debts
 - (iv) interest owed
 - (v) currency exchange losses
 - (vi) bank costs charged by the beneficiary's bank for transfers from the granting authority
 - (vii) excessive or reckless expenditure
 - (viii) deductible or refundable VAT (including VAT paid by public bodies acting as public authority)
 - (ix) costs incurred or contributions for activities implemented during grant agreement suspension (see Article 31)
 - (x) in-kind contributions by third parties: not applicable
- (b) costs or contributions declared under other EU grants (or grants awarded by an EU Member State, non-EU country or other body implementing the EU budget), except for the following cases:
 - (i) Synergy actions: not applicable
 - (ii) if the action grant is combined with an operating grant¹² running during the same period and the beneficiary can demonstrate that the operating grant does not cover any (direct or indirect) costs of the action grant
- (c) costs or contributions for staff of a national (or regional/local) administration, for activities that are part of the administration's normal activities (i.e. not undertaken only because of the grant)
- (d) costs or contributions (especially travel and subsistence) for staff or representatives of EU institutions, bodies or agencies
- (e) other :
 - (i) costs or contributions for activities that do not take place in one of the eligible countries or target countries set out in the call conditions — unless approved by the granting authority

¹² For the definition, see Article 180(2)(b) of EU Financial Regulation 2018/1046: '**operating grant**' means an EU grant to finance "the functioning of a body which has an objective forming part of and supporting an EU policy".

- (ii) costs or contributions declared specifically ineligible in the call conditions.

6.4 Consequences of non-compliance

If a beneficiary declares costs or contributions that are ineligible, they will be rejected (see Article 27).

This may also lead to other measures described in Chapter 5.

CHAPTER 4 GRANT IMPLEMENTATION

SECTION 1 CONSORTIUM: BENEFICIARIES, AFFILIATED ENTITIES AND OTHER PARTICIPANTS

ARTICLE 7 — BENEFICIARIES

The beneficiaries, as signatories of the Agreement, are fully responsible towards the granting authority for implementing it and for complying with all its obligations.

They must implement the Agreement to their best abilities, in good faith and in accordance with all the obligations and terms and conditions it sets out.

They must have the appropriate resources to implement the action and implement the action under their own responsibility and in accordance with Article 11. If they rely on affiliated entities or other participants (see Articles 8 and 9), they retain sole responsibility towards the granting authority and the other beneficiaries.

They are jointly responsible for the *technical* implementation of the action. If one of the beneficiaries fails to implement their part of the action, the other beneficiaries must ensure that this part is implemented by someone else (without being entitled to an increase of the maximum grant amount and subject to an amendment; see Article 39). The *financial* responsibility of each beneficiary in case of recoveries is governed by Article 22.

The beneficiaries (and their action) must remain eligible under the EU programme funding the grant for the entire duration of the action. Costs and contributions will be eligible only as long as the beneficiary and the action are eligible.

The **internal roles and responsibilities** of the beneficiaries are divided as follows:

(a) Each beneficiary must:

- (i) keep information stored in the Portal Participant Register up to date (see Article 19)
- (ii) inform the granting authority (and the other beneficiaries) immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 19)
- (iii) submit to the coordinator in good time:
 - the prefinancing guarantees (if required; see Article 23)



- the financial statements and certificates on the financial statements (CFS) (if required; see Articles 21 and 24.2 and Data Sheet, Point 4.3)
 - the contribution to the deliverables and technical reports (see Article 21)
 - any other documents or information required by the granting authority under the Agreement
- (iv) submit via the Portal data and information related to the participation of their affiliated entities.
- (b) The coordinator must:
- (i) monitor that the action is implemented properly (see Article 11)
 - (ii) act as the intermediary for all communications between the consortium and the granting authority, unless the Agreement or granting authority specifies otherwise, and in particular:
 - submit the prefinancing guarantees to the granting authority (if any)
 - request and review any documents or information required and verify their quality and completeness before passing them on to the granting authority
 - submit the deliverables and reports to the granting authority
 - inform the granting authority about the payments made to the other beneficiaries (report on the distribution of payments; if required, see Articles 22 and 32)
 - (iii) distribute the payments received from the granting authority to the other beneficiaries without unjustified delay (see Article 22).

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including affiliated entities).

However, coordinators which are public bodies may delegate the tasks set out in Point (b)(ii) last indent and (iii) above to entities with ‘authorisation to administer’ which they have created or which are controlled by or affiliated to them. In this case, the coordinator retains sole responsibility for the payments and for compliance with the obligations under the Agreement.

Moreover, coordinators which are ‘sole beneficiaries’¹³ (or similar, such as European research infrastructure consortia (ERICs)) may delegate the tasks set out in Point (b)(i) to (iii) above to one of their members. The coordinator retains sole responsibility for compliance with the obligations under the Agreement.

The beneficiaries must have **internal arrangements** regarding their operation and co-ordination, to ensure that the action is implemented properly.

¹³ For the definition, see Article 187(2) EU Financial Regulation 2018/1046: “Where several entities satisfy the criteria for being awarded a grant and together form one entity, that entity may be treated as the **sole beneficiary**, including where it is specifically established for the purpose of implementing the action financed by the grant.”

If required by the granting authority (see Data Sheet, Point 1), these arrangements must be set out in a written **consortium agreement** between the beneficiaries, covering for instance:

- the internal organisation of the consortium
- the management of access to the Portal
- different distribution keys for the payments and financial responsibilities in case of recoveries (if any)
- additional rules on rights and obligations related to background and results (see Article 16)
- settlement of internal disputes
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal arrangements must not contain any provision contrary to this Agreement.

ARTICLE 8 — AFFILIATED ENTITIES

The following entities which are linked to a beneficiary will participate in the action as ‘affiliated entities’:

- **SNCF VOYAGEURS (SNCF VOYAGEURS)**, PIC 893626081, linked to SOCIETE NATIONALE SNCF (SNCF)

Affiliated entities can charge costs and contributions to the action under the same conditions as the beneficiaries and must implement the action tasks attributed to them in Annex 1 in accordance with Article 11.

Their costs and contributions will be included in Annex 2 and will be taken into account for the calculation of the grant.

The beneficiaries must ensure that all their obligations under this Agreement also apply to their affiliated entities.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the affiliated entities.

Breaches by affiliated entities will be handled in the same manner as breaches by beneficiaries. Recovery of undue amounts will be handled through the beneficiaries.

If the granting authority requires joint and several liability of affiliated entities (see Data Sheet, Point 4.4), they must sign the declaration set out in Annex 3a and may be held liable in case of enforced recoveries against their beneficiaries (see Article 22.2 and 22.4).

ARTICLE 9 — OTHER PARTICIPANTS INVOLVED IN THE ACTION

9.1 Associated partners

Not applicable

9.2 Third parties giving in-kind contributions to the action

Other third parties may give in-kind contributions to the action (i.e. personnel, equipment, other goods, works and services, etc. which are free-of-charge) if necessary for the implementation.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge costs or contributions to the action, but the costs for the in-kind contributions are eligible and may be charged by the beneficiaries which use them, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The third parties and their in-kind contributions should be set out in Annex 1.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the third parties giving in-kind contributions.

9.3 Subcontractors

Subcontractors may participate in the action, if necessary for the implementation.

Subcontractors must implement their action tasks in accordance with Article 11. The costs for the subcontracted tasks (invoiced price from the subcontractor) are eligible and may be charged by the beneficiaries, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the subcontractors.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the subcontractors.

9.4 Recipients of financial support to third parties

If the action includes providing financial support to third parties (e.g. grants, prizes or similar forms of support), the beneficiaries must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the third parties receiving the support (recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the recipients.

ARTICLE 10 — PARTICIPANTS WITH SPECIAL STATUS

10.1 Non-EU participants

Participants which are established in a non-EU country (if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles,

environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)

- for the submission of certificates under Article 24: to use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC¹⁴
- for the controls under Article 25: to allow for checks, reviews, audits and investigations (including on-the-spot checks, visits and inspections) by the bodies mentioned in that Article (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.).

Special rules on dispute settlement apply (see Data Sheet, Point 5).

10.2 Participants which are international organisations

Participants which are international organisations (IOs; if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)
- for the submission of certificates under Article 24: to use either independent public officers or external auditors which comply with comparable standards as those set out in EU Directive 2006/43/EC
- for the controls under Article 25: to allow for the checks, reviews, audits and investigations by the bodies mentioned in that Article, taking into account the specific agreements concluded by them and the EU (if any).

For such participants, nothing in the Agreement will be interpreted as a waiver of their privileges or immunities, as accorded by their constituent documents or international law.

Special rules on applicable law and dispute settlement apply (see Article 43 and Data Sheet, Point 5).

10.3 Pillar-assessed participants

Pillar-assessed participants (if any) may rely on their own systems, rules and procedures, in so far as they have been positively assessed and do not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries.

‘Pillar-assessment’ means a review by the European Commission on the systems, rules and procedures which participants use for managing EU grants (in particular internal control system, accounting system, external audits, financing of third parties, rules on recovery and exclusion, information on recipients and protection of personal data; see Article 154 EU Financial Regulation 2018/1046).

Participants with a positive pillar assessment may rely on their own systems, rules and procedures, in particular for:

¹⁴ Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

- record-keeping (Article 20): may be done in accordance with internal standards, rules and procedures
- currency conversion for financial statements (Article 21): may be done in accordance with usual accounting practices
- guarantees (Article 23): for public law bodies, prefinancing guarantees are not needed
- certificates (Article 24):
 - certificates on the financial statements (CFS): may be provided by their regular internal or external auditors and in accordance with their internal financial regulations and procedures
 - certificates on usual accounting practices (CoMUC): are not needed if those practices are covered by an ex-ante assessment

and use the following specific rules, for:

- recoveries (Article 22): in case of financial support to third parties, there will be no recovery if the participant has done everything possible to retrieve the undue amounts from the third party receiving the support (including legal proceedings) and non-recovery is not due to an error or negligence on its part
- checks, reviews, audits and investigations by the EU (Article 25): will be conducted taking into account the rules and procedures specifically agreed between them and the framework agreement (if any)
- impact evaluation (Article 26): will be conducted in accordance with the participant's internal rules and procedures and the framework agreement (if any)
- grant agreement suspension (Article 31): certain costs incurred during grant suspension are eligible (notably, minimum costs necessary for a possible resumption of the action and costs relating to contracts which were entered into before the pre-information letter was received and which could not reasonably be suspended, reallocated or terminated on legal grounds)
- grant agreement termination (Article 32): the final grant amount and final payment will be calculated taking into account also costs relating to contracts due for execution only after termination takes effect, if the contract was entered into before the pre-information letter was received and could not reasonably be terminated on legal grounds
- liability for damages (Article 33.2): the granting authority must be compensated for damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement only if the damage is due to an infringement of the participant's internal rules and procedures or due to a violation of third parties' rights by the participant or one of its employees or individual for whom the employees are responsible.

Participants whose pillar assessment covers procurement and granting procedures may also do purchases, subcontracting and financial support to third parties (Article 6.2) in accordance with their internal rules and procedures for purchases, subcontracting and financial support.

Participants whose pillar assessment covers data protection rules may rely on their internal standards, rules and procedures for data protection (Article 15).

The participants may however not rely on provisions which would breach the principle of equal treatment of applicants or beneficiaries or call into question the decision awarding the grant, such as in particular:

- eligibility (Article 6)
- consortium roles and set-up (Articles 7-9)
- security and ethics (Articles 13, 14)
- IPR (including background and results, access rights and rights of use), communication, dissemination and visibility (Articles 16 and 17)
- information obligation (Article 19)
- payment, reporting and amendments (Articles 21, 22 and 39)
- rejections, reductions, suspensions and terminations (Articles 27, 28, 29-32)

If the pillar assessment was subject to remedial measures, reliance on the internal systems, rules and procedures is subject to compliance with those remedial measures.

Participants whose assessment has not yet been updated to cover (the new rules on) data protection may rely on their internal systems, rules and procedures, provided that they ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subject
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the personal data.

Participants must inform the coordinator without delay of any changes to the systems, rules and procedures that were part of the pillar assessment. The coordinator must immediately inform the granting authority.

Pillar-assessed participants that have also concluded a framework agreement with the EU, may moreover — under the same conditions as those above (i.e. not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries) — rely on the provisions set out in that framework agreement.

SECTION 2 RULES FOR CARRYING OUT THE ACTION

ARTICLE 11 — PROPER IMPLEMENTATION OF THE ACTION

11.1 Obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement, the call conditions and all legal obligations under applicable EU, international and national law.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 12 — CONFLICT OF INTERESTS

12.1 Conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the Agreement could be compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other direct or indirect interest ('conflict of interests').

They must formally notify the granting authority without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The granting authority may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the beneficiary may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 13 — CONFIDENTIALITY AND SECURITY

13.1 Sensitive information

The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet (see Point 6).

If a beneficiary requests, the granting authority may agree to keep such information confidential for a longer period.

Unless otherwise agreed between the parties, they may use sensitive information only to implement the Agreement.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

- (a) need to know it in order to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

The granting authority may disclose sensitive information to its staff and to other EU institutions and bodies.

It may moreover disclose sensitive information to third parties, if:

- (a) this is necessary to implement the Agreement or safeguard the EU financial interests and
- (b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party
- (b) the information becomes publicly available, without breaching any confidentiality obligation
- (c) the disclosure of the sensitive information is required by EU, international or national law.

Specific confidentiality rules (if any) are set out in Annex 5.

13.2 Classified information

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/444¹⁵ and its implementing rules).

Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting authority.

Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

Specific security rules (if any) are set out in Annex 5.

13.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

¹⁵ Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 14 — ETHICS AND VALUES

14.1 Ethics

The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

Specific ethics rules (if any) are set out in Annex 5.

14.2 Values

The beneficiaries must commit to and ensure the respect of basic EU values (such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

Specific rules on values (if any) are set out in Annex 5.

14.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 15 — DATA PROTECTION

15.1 Data processing by the granting authority

Any personal data under the Agreement will be processed under the responsibility of the data controller of the granting authority in accordance with and for the purposes set out in the Portal Privacy Statement.

For grants where the granting authority is the European Commission, an EU regulatory or executive agency, joint undertaking or other EU body, the processing will be subject to Regulation 2018/1725¹⁶.

15.2 Data processing by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (in particular, Regulation 2016/679¹⁷).

They must ensure that personal data is:

¹⁶ Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).

¹⁷ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC ('GDPR') (OJ L 119, 4.5.2016, p. 1).

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation.

The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement.

15.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 16 — INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE

16.1 Background and access rights to background

The beneficiaries must give each other and the other participants access to the background identified as needed for implementing the action, subject to any specific rules in Annex 5.

‘Background’ means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

- (a) held by the beneficiaries before they acceded to the Agreement and
- (b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

16.2 Ownership of results

The granting authority does not obtain ownership of the results produced under the action.

‘Results’ means any tangible or intangible effect of the action, such as data, know-how or information,

whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

16.3 Rights of use of the granting authority on materials, documents and information received for policy, information, communication, dissemination and publicity purposes

The granting authority has the right to use non-sensitive information relating to the action and materials and documents received from the beneficiaries (notably summaries for publication, deliverables, as well as any other material, such as pictures or audio-visual material, in paper or electronic form) for policy, information, communication, dissemination and publicity purposes — during the action or afterwards.

The right to use the beneficiaries' materials, documents and information is granted in the form of a royalty-free, non-exclusive and irrevocable licence, which includes the following rights:

- (a) **use for its own purposes** (in particular, making them available to persons working for the granting authority or any other EU service (including institutions, bodies, offices, agencies, etc.) or EU Member State institution or body; copying or reproducing them in whole or in part, in unlimited numbers; and communication through press information services)
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes)
- (c) **editing or redrafting** (including shortening, summarising, inserting other elements (e.g. meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation)
- (d) **translation**
- (e) **storage** in paper, electronic or other form
- (f) **archiving**, in line with applicable document-management rules
- (g) the right to authorise **third parties** to act on its behalf or sub-license to third parties the modes of use set out in Points (b), (c), (d) and (f), if needed for the information, communication and publicity activity of the granting authority
- (h) **processing**, analysing, aggregating the materials, documents and information received and **producing derivative works**.

The rights of use are granted for the whole duration of the industrial or intellectual property rights concerned.

If materials or documents are subject to moral rights or third party rights (including intellectual property rights or rights of natural persons on their image and voice), the beneficiaries must ensure that they comply with their obligations under this Agreement (in particular, by obtaining the necessary licences and authorisations from the rights holders concerned).

Where applicable, the granting authority will insert the following information:

“© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the [name of granting authority] under conditions.”

16.4 Specific rules on IPR, results and background

Specific rules regarding intellectual property rights, results and background (if any) are set out in Annex 5.

16.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

ARTICLE 17 — COMMUNICATION, DISSEMINATION AND VISIBILITY

17.1 Communication — Dissemination — Promoting the action

Unless otherwise agreed with the granting authority, the beneficiaries must promote the action and its results by providing targeted information to multiple audiences (including the media and the public), in accordance with Annex 1 and in a strategic, coherent and effective manner.

Before engaging in a communication or dissemination activity expected to have a major media impact, the beneficiaries must inform the granting authority.

17.2 Visibility — European flag and funding statement

Unless otherwise agreed with the granting authority, communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge EU support and display the European flag (emblem) and funding statement (translated into local languages, where appropriate):



Funded by the
European Union



Co-funded by the
European Union



Funded by the
European Union



Co-funded by the
European Union

The emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

Apart from the emblem, no other visual identity or logo may be used to highlight the EU support.

When displayed in association with other logos (e.g. of beneficiaries or sponsors), the emblem must be displayed at least as prominently and visibly as the other logos.

For the purposes of their obligations under this Article, the beneficiaries may use the emblem without first obtaining approval from the granting authority. This does not, however, give them the right to exclusive use. Moreover, they may not appropriate the emblem or any similar trademark or logo, either by registration or by any other means.

17.3 Quality of information — Disclaimer

Any communication or dissemination activity related to the action must use factually accurate information.

Moreover, it must indicate the following disclaimer (translated into local languages where appropriate):

“Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [name of the granting authority]. Neither the European Union nor the granting authority can be held responsible for them.”

17.4 Specific communication, dissemination and visibility rules

Specific communication, dissemination and visibility rules (if any) are set out in Annex 5.

17.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 18 — SPECIFIC RULES FOR CARRYING OUT THE ACTION

18.1 Specific rules for carrying out the action

Specific rules for implementing the action (if any) are set out in Annex 5.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

SECTION 3 GRANT ADMINISTRATION

ARTICLE 19 — GENERAL INFORMATION OBLIGATIONS

19.1 Information requests

The beneficiaries must provide — during the action or afterwards and in accordance with Article 7 — any information requested in order to verify eligibility of the costs or contributions declared, proper implementation of the action and compliance with the other obligations under the Agreement.

The information provided must be accurate, precise and complete and in the format requested, including electronic format.

19.2 Participant Register data updates

The beneficiaries must keep — at all times, during the action or afterwards — their information stored in the Portal Participant Register up to date, in particular, their name, address, legal representatives, legal form and organisation type.

19.3 Information about events and circumstances which impact the action

The beneficiaries must immediately inform the granting authority (and the other beneficiaries) of any of the following:

- (a) **events** which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:
 - (i) changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration of honour signed before grant signature)
 - (ii) linked action information: not applicable
- (b) **circumstances** affecting:
 - (i) the decision to award the grant or
 - (ii) compliance with requirements under the Agreement.

19.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 20 — RECORD-KEEPING

20.1 Keeping records and supporting documents

The beneficiaries must — at least until the time-limit set out in the Data Sheet (see Point 6) — keep records and other supporting documents to prove the proper implementation of the action in line with the accepted standards in the respective field (if any).

In addition, the beneficiaries must — for the same period — keep the following to justify the amounts declared:

- (a) for actual costs: adequate records and supporting documents to prove the costs declared (such as contracts, subcontracts, invoices and accounting records); in addition, the beneficiaries' usual accounting and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documents
- (b) for flat-rate costs and contributions (if any): adequate records and supporting documents to prove the eligibility of the costs or contributions to which the flat-rate is applied
- (c) for the following simplified costs and contributions: the beneficiaries do not need to keep specific records on the actual costs incurred, but must keep:
 - (i) for unit costs and contributions (if any): adequate records and supporting documents to prove the number of units declared
 - (ii) for lump sum costs and contributions (if any): adequate records and supporting documents to prove proper implementation of the work as described in Annex 1
 - (iii) for financing not linked to costs (if any): adequate records and supporting documents to prove the achievement of the results or the fulfilment of the conditions as described in Annex 1
- (d) for unit, flat-rate and lump sum costs and contributions according to usual cost accounting practices (if any): the beneficiaries must keep any adequate records and supporting documents to prove that their cost accounting practices have been applied in a consistent manner, based on objective criteria, regardless of the source of funding, and that they comply with the eligibility conditions set out in Articles 6.1 and 6.2.

Moreover, the following is needed for specific budget categories:

- (e) for personnel costs: time worked for the beneficiary under the action must be supported by declarations signed monthly by the person and their supervisor, unless another reliable time-record system is in place; the granting authority may accept alternative evidence supporting the time worked for the action declared, if it considers that it offers an adequate level of assurance
- (f) additional record-keeping rules: not applicable

The records and supporting documents must be made available upon request (see Article 19) or in the context of checks, reviews, audits or investigations (see Article 25).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 25), the beneficiaries must keep these records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

20.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 21 — REPORTING

21.1 Continuous reporting

The beneficiaries must continuously report on the progress of the action (e.g. **deliverables, milestones, outputs/outcomes, critical risks, indicators**, etc; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority).

Standardised deliverables (e.g. progress reports not linked to payments, reports on cumulative expenditure, special reports, etc; if any) must be submitted using the templates published on the Portal.

21.2 Periodic reporting: Technical reports and financial statements

In addition, the beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2):

- for additional prefinancings (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part.

The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool.

The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities)
- the explanation on the use of resources (or detailed cost reporting table, if required)

- the certificates on the financial statements (CFS) (if required; see Article 24.2 and Data Sheet, Point 4.3).

The **financial statements** must detail the eligible costs and contributions for each budget category and, for the final payment, also the revenues for the action (see Articles 6 and 22).

All eligible costs and contributions incurred should be declared, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts that are not declared in the individual financial statements will not be taken into account by the granting authority.

By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries confirm that:

- the information provided is complete, reliable and true
- the costs and contributions declared are eligible (see Article 6)
- the costs and contributions can be substantiated by adequate records and supporting documents (see Article 20) that will be produced upon request (see Article 19) or in the context of checks, reviews, audits and investigations (see Article 25)
- for the final periodic report: all the revenues have been declared (if required; see Article 22).

Beneficiaries will have to submit also the financial statements of their affiliated entities (if any). In case of recoveries (see Article 22), beneficiaries will be held responsible also for the financial statements of their affiliated entities.

21.3 Currency for financial statements and conversion into euros

The financial statements must be drafted in euro.

Beneficiaries with general accounts established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union* (ECB website), calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal* for the currency in question, they must be converted at the average of the monthly accounting exchange rates published on the European Commission website (InforEuro), calculated over the corresponding reporting period.

Beneficiaries with general accounts in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

21.4 Reporting language

The reporting must be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

21.5 Consequences of non-compliance

If a report submitted does not comply with this Article, the granting authority may suspend the payment deadline (see Article 29) and apply other measures described in Chapter 5.

If the coordinator breaches its reporting obligations, the granting authority may terminate the grant or the coordinator's participation (see Article 32) or apply other measures described in Chapter 5.

ARTICLE 22 — PAYMENTS AND RECOVERIES — CALCULATION OF AMOUNTS DUE

22.1 Payments and payment arrangements

Payments will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

They will be made in euro to the bank account indicated by the coordinator (see Data Sheet, Point 4.2) and must be distributed without unjustified delay (restrictions may apply to distribution of the initial prefinancing payment; see Data Sheet, Point 4.2).

Payments to this bank account will discharge the granting authority from its payment obligation.

The cost of payment transfers will be borne as follows:

- the granting authority bears the cost of transfers charged by its bank
- the beneficiary bears the cost of transfers charged by its bank
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

Payments by the granting authority will be considered to have been carried out on the date when they are debited to its account.

22.2 Recoveries

Recoveries will be made, if — at beneficiary termination, final payment or afterwards — it turns out that the granting authority has paid too much and needs to recover the amounts undue.

Each beneficiary's financial responsibility in case of recovery is in principle limited to their own debt and undue amounts of their affiliated entities.

In case of enforced recoveries (see Article 22.4), affiliated entities will be held liable for repaying debts of their beneficiaries, if required by the granting authority (see Data Sheet, Point 4.4).

22.3 Amounts due

22.3.1 Prefinancing payments

The aim of the prefinancing is to provide the beneficiaries with a float.

It remains the property of the EU until the final payment.

For **initial prefinancings** (if any), the amount due, schedule and modalities are set out in the Data Sheet (see Point 4.2).

For **additional prefinancings** (if any), the amount due, schedule and modalities are also set out in the Data Sheet (see Point 4.2). However, if the statement on the use of the previous prefinancing

payment shows that less than 70% was used, the amount set out in the Data Sheet will be reduced by the difference between the 70% threshold and the amount used.

The contribution to the Mutual Insurance Mechanism will be retained from the prefinancing payments (at the rate and in accordance with the modalities set out in the Data Sheet, see Point 4.2) and transferred to the Mechanism.

Prefinancing payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.2 Amount due at beneficiary termination — Recovery

In case of beneficiary termination, the granting authority will determine the provisional amount due for the beneficiary concerned. Payments (if any) will be made with the next interim or final payment.

The **amount due** will be calculated in the following step:

Step 1 — Calculation of the total accepted EU contribution

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the beneficiary for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the accepted costs of the beneficiary), taking into account requests for a lower contribution to costs and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution' for the beneficiary.

The **balance** is then calculated by deducting the payments received (if any; see report on the distribution of payments in Article 32), from the total accepted EU contribution:

$$\begin{aligned} & \{\text{total accepted EU contribution for the beneficiary} \\ & \text{minus} \\ & \{\text{prefinancing and interim payments received (if any)}\} \}. \end{aligned}$$

If the balance is **positive**, the amount will be included in the next interim or final payment to the consortium.

If the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount due, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered and ask this amount to be paid to the coordinator (**confirmation letter**).

If payment is not made to the coordinator by the date specified in the confirmation letter, the granting authority may call on the Mutual Insurance Mechanism to intervene, if continuation of the action is guaranteed and the conditions set out in the rules governing the Mechanism are met.

In this case, it will send a **beneficiary recovery letter**, together with a **debit note** with the terms and date for payment.

The debit note for the beneficiary will include the amount calculated for the affiliated entities which also had to end their participation (if any).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

The amounts will later on also be taken into account for the next interim or final payment.

22.3.3 Interim payments

Interim payments reimburse the eligible costs and contributions claimed for the implementation of the action during the reporting periods (if any).

Interim payments (if any) will be made in accordance with the schedule and modalities set out the Data Sheet (see Point 4.2).

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **interim payment** will be calculated by the granting authority in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the interim payment ceiling

Step 1 — Calculation of the total accepted EU contribution

The granting authority will calculate the ‘accepted EU contribution’ for the action for the reporting period, by first calculating the ‘maximum EU contribution to costs’ (applying the funding rate to the accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions from beneficiary termination (if any). The resulting amount is the ‘total accepted EU contribution’.

Step 2 — Limit to the interim payment ceiling

The resulting amount is then capped to ensure that the total amount of prefinancing and interim payments (if any) does not exceed the interim payment ceiling set out in the Data Sheet (see Point 4.2).

Interim payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.4 Final payment — Final grant amount — Revenues and Profit — Recovery

The final payment (payment of the balance) reimburses the remaining part of the eligible costs and contributions claimed for the implementation of the action (if any).

The final payment will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

Payment is subject to the approval of the final periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **final grant amount for the action** will be calculated in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the action for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the total accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the maximum grant amount

If the resulting amount is higher than the maximum grant amount set out in Article 5.2, it will be limited to the latter.

Step 3 — Reduction due to the no-profit rule

If the no-profit rule is provided for in the Data Sheet (see Point 4.2), the grant must not produce a profit (i.e. surplus of the amount obtained following Step 2 plus the action's revenues, over the eligible costs and contributions approved by the granting authority).

‘Revenue’ is all income generated by the action, during its duration (see Article 4), for beneficiaries that are profit legal entities (— with the exception of income generated by the exploitation of results, which are not considered as revenues).

If there is a profit, it will be deducted in proportion to the final rate of reimbursement of the eligible costs approved by the granting authority (as compared to the amount calculated following Steps 1 and 2 minus the contributions).

The **balance** (final payment) is then calculated by deducting the total amount of prefinancing and interim payments already made (if any), from the final grant amount:

$$\begin{aligned} &\{\text{final grant amount} \\ &\text{minus} \\ &\{\text{prefinancing and interim payments made (if any)}\}\}. \end{aligned}$$

If the balance is **positive**, it will be **paid** to the coordinator.

The amount retained for the Mutual Insurance Mechanism (see above) will be released and **paid** to the coordinator (in accordance with the rules governing the Mechanism).

The final payment (or part of it) may be offset (without the beneficiaries’ consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

If — despite the release of the Mutual Insurance Mechanism contribution — the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to recover, the final grant amount, the amount to be recovered and the reasons why
- requesting a report on the distribution of payments to the beneficiaries within 30 days of receiving notification and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received) and the coordinator has submitted the report on the distribution of payments, it will calculate the **share of the debt per beneficiary**, by:

- (a) identifying the beneficiaries for which the amount calculated as follows is negative:

$$\begin{aligned} &\{\{\text{total accepted EU contribution for the beneficiary} \\ &\text{divided by} \end{aligned}$$

total accepted EU contribution for the action}
 multiplied by
 final grant amount for the action},
 minus
 {prefinancing and interim payments received by the beneficiary (if any)} }

and

(b) dividing the debt:

{amount calculated according to point (a) for the beneficiary concerned
 divided by
 the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to
 point (a)}
 multiplied by
 the amount to be recovered}.

and confirm the amount to be recovered from each beneficiary concerned (**confirmation letter**), together with **debit notes** with the terms and date for payment.

The debit notes for beneficiaries will include the amounts calculated for their affiliated entities (if any).

If the coordinator has not submitted the report on the distribution of payments, the granting authority will **recover** the full amount from the coordinator (**confirmation letter** and **debit note** with the terms and date for payment).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.3.5 Audit implementation after final payment — Revised final grant amount — Recovery

If — after the final payment (in particular, after checks, reviews, audits or investigations; see Article 25) — the granting authority rejects costs or contributions (see Article 27) or reduces the grant (see Article 28), it will calculate the **revised final grant amount** for the beneficiary concerned.

The **beneficiary revised final grant amount** will be calculated in the following step:

Step 1 — Calculation of the revised total accepted EU contribution

Step 1 — Calculation of the revised total accepted EU contribution

The granting authority will first calculate the ‘revised accepted EU contribution’ for the beneficiary, by calculating the ‘revised accepted costs’ and ‘revised accepted contributions’.

After that, it will take into account grant reductions (if any). The resulting ‘revised total accepted EU contribution’ is the beneficiary revised final grant amount.

If the revised final grant amount is lower than the beneficiary's final grant amount (i.e. its share in the final grant amount for the action), it will be **recovered** in accordance with the following procedure:

The **beneficiary final grant amount** (i.e. share in the final grant amount for the action) is calculated as follows:

$$\left\{ \begin{array}{l} \text{total accepted EU contribution for the beneficiary} \\ \text{divided by} \\ \text{total accepted EU contribution for the action} \end{array} \right\} \times \text{final grant amount for the action}.$$

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered (**confirmation letter**), together with a **debit note** with the terms and the date for payment.

Recoveries against affiliated entities (if any) will be handled through their beneficiaries.

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.4 Enforced recovery

If payment is not made by the date specified in the debit note, the amount due will be recovered:

- (a) by offsetting the amount — without the coordinator or beneficiary's consent — against any amounts owed to the coordinator or beneficiary by the granting authority.

In exceptional circumstances, to safeguard the EU financial interests, the amount may be offset before the payment date specified in the debit note.

For grants where the granting authority is the European Commission or an EU executive agency, debts may also be offset against amounts owed by other Commission services or executive agencies.

- (b) financial guarantee(s): not applicable
- (c) joint and several liability of beneficiaries: not applicable
- (d) by holding affiliated entities jointly and severally liable (if any, see Data Sheet, Point 4.4)
- (e) by taking legal action (see Article 43) or, provided that the granting authority is the European Commission or an EU executive agency, by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 100(2) of EU Financial Regulation 2018/1046.

If the Mutual Insurance Mechanism was called on by the granting authority to intervene, recovery will be continued in the name of the Mutual Insurance Mechanism. If two debit notes were sent, the second one (in the name of the Mutual Insurance Mechanism) will be considered to replace the first one (in the name of the granting authority). Where the MIM intervened, offsetting, enforceable decisions or any other of the above-mentioned forms of enforced recovery may be used mutatis mutandis.

The amount to be recovered will be increased by **late-payment interest** at the rate set out in Article 22.5, from the day following the payment date in the debit note, up to and including the date the full payment is received.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2015/2366¹⁸ applies.

For grants where the granting authority is an EU executive agency, enforced recovery by offsetting or enforceable decision will be done by the services of the European Commission (see also Article 43).

22.5 Consequences of non-compliance

22.5.1 If the granting authority does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus the rate specified in the Data Sheet (Point 4.2). The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only on request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

If payments or the payment deadline are suspended (see Articles 29 and 30), payment will not be considered as late.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

22.5.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the coordinator may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 23 — GUARANTEES

¹⁸ Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, p. 35).

Not applicable

ARTICLE 24 — CERTIFICATES

24.1 Operational verification report (OVR)

Not applicable

24.2 Certificate on the financial statements (CFS)

If required by the granting authority (see Data Sheet, Point 4.3), the beneficiaries must provide certificates on their financial statements (CFS), in accordance with the schedule, threshold and conditions set out in the Data Sheet.

The coordinator must submit them as part of the periodic report (see Article 21).

The certificates must be drawn up using the template published on the Portal, cover the costs declared on the basis of actual costs and costs according to usual cost accounting practices (if any), and fulfil the following conditions:

- (a) be provided by a qualified approved external auditor which is independent and complies with Directive 2006/43/EC¹⁹ (or for public bodies: by a competent independent public officer)
- (b) the verification must be carried out according to the highest professional standards to ensure that the financial statements comply with the provisions under the Agreement and that the costs declared are eligible.

The certificates will not affect the granting authority's right to carry out its own checks, reviews or audits, nor preclude the European Court of Auditors (ECA), the European Public Prosecutor's Office (EPPO) or the European Anti-Fraud Office (OLAF) from using their prerogatives for audits and investigations under the Agreement (see Article 25).

If the costs (or a part of them) were already audited by the granting authority, these costs do not need to be covered by the certificate and will not be counted for calculating the threshold (if any).

24.3 Certificate on the compliance of usual cost accounting practices (CoMUC)

Not applicable

24.4 Systems and process audit (SPA)

Beneficiaries which:

- use unit, flat rate or lump sum costs or contributions according to documented (i.e. formally approved and in writing) usual costs accounting practices (if any) or
- have formalised documentation on the systems and processes for calculating their costs and contributions (i.e. formally approved and in writing), have participated in at least 150 actions under Horizon 2020 or the Euratom Research and Training Programme (2014-2018 or

¹⁹ Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

2019-2020) and participate in at least 3 ongoing actions under Horizon Europe or the Euratom Research and Training Programme (2021-2025 or 2026-2027)

may apply to the granting authority for a systems and process audit (SPA).

This audit will be carried out as follows:

Step 1 – Application by the beneficiary.

Step 2 – If the application is accepted, the granting authority will carry out the systems and process audit, complemented by an audit of transactions (on a sample of the beneficiary's Horizon Europe or the Euratom Research and Training Programme financial statements).

Step 3 – The audit result will take the form of a risk assessment classification for the beneficiary: low, medium or high.

Low-risk beneficiaries will benefit from less (or less in-depth) ex-post audits (see Article 25) and a higher threshold for submitting certificates on the financial statements (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3).

24.5 Consequences of non-compliance

If a beneficiary does not submit a certificate on the financial statements (CFS) or the certificate is rejected, the accepted EU contribution to costs will be capped to reflect the CFS threshold.

If a beneficiary breaches any of its other obligations under this Article, the granting authority may apply the measures described in Chapter 5.

ARTICLE 25 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

25.1 Granting authority checks, reviews and audits

25.1.1 Internal checks

The granting authority may — during the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing costs and contributions, deliverables and reports.

25.1.2 Project reviews

The granting authority may carry out reviews on the proper implementation of the action and compliance with the obligations under the Agreement (general project reviews or specific issues reviews).

Such project reviews may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiary concerned and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent, outside experts. If it uses outside experts, the coordinator or beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The coordinator or beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The granting authority may request beneficiaries to provide such information to it directly. Sensitive information and documents will be treated in accordance with Article 13.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with the outside experts.

For **on-the-spot visits**, the beneficiary concerned must allow access to sites and premises (including to the outside experts) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a **project review report** will be drawn up.

The granting authority will formally notify the project review report to the coordinator or beneficiary concerned, which has 30 days from receiving notification to make observations.

Project reviews (including project review reports) will be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

25.1.3 Audits

The granting authority may carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Such audits may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the beneficiary concerned and will be considered to start on the date of the notification.

The granting authority may use its own audit service, delegate audits to a centralised service or use external audit firms. If it uses an external firm, the beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. Sensitive information and documents will be treated in accordance with Article 13.

For **on-the-spot** visits, the beneficiary concerned must allow access to sites and premises (including for the external audit firm) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **draft audit report** will be drawn up.

The auditors will formally notify the draft audit report to the beneficiary concerned, which has 30 days from receiving notification to make observations (contradictory audit procedure).

The **final audit report** will take into account observations by the beneficiary concerned and will be formally notified to them.

Audits (including audit reports) will be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

25.2 European Commission checks, reviews and audits in grants of other granting authorities

Where the granting authority is not the European Commission, the latter has the same rights of checks, reviews and audits as the granting authority.

25.3 Access to records for assessing simplified forms of funding

The beneficiaries must give the European Commission access to their statutory records for the periodic assessment of simplified forms of funding which are used in EU programmes.

25.4 OLAF, EPPO and ECA audits and investigations

The following bodies may also carry out checks, reviews, audits and investigations — during the action or afterwards:

- the European Anti-Fraud Office (OLAF) under Regulations No 883/2013²⁰ and No 2185/96²¹
- the European Public Prosecutor's Office (EPPO) under Regulation 2017/1939
- the European Court of Auditors (ECA) under Article 287 of the Treaty on the Functioning of the EU (TFEU) and Article 257 of EU Financial Regulation 2018/1046.

If requested by these bodies, the beneficiary concerned must provide full, accurate and complete information in the format requested (including complete accounts, individual salary statements or other personal data, including in electronic format) and allow access to sites and premises for on-the-spot visits or inspections — as provided for under these Regulations.

To this end, the beneficiary concerned must keep all relevant information relating to the action, at least until the time-limit set out in the Data Sheet (Point 6) and, in any case, until any ongoing checks, reviews, audits, investigations, litigation or other pursuits of claims have been concluded.

25.5 Consequences of checks, reviews, audits and investigations — Extension of results of reviews, audits or investigations

25.5.1 Consequences of checks, reviews, audits and investigations in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to rejections (see Article 27), grant reduction (see Article 28) or other measures described in Chapter 5.

²⁰ Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18/09/2013, p. 1).

²¹ Council Regulation (Euratom, EC) No 2185/96 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15/11/1996, p. 2).

Rejections or grant reductions after the final payment will lead to a revised final grant amount (see Article 22).

Findings in checks, reviews, audits or investigations during the action implementation may lead to a request for amendment (see Article 39), to change the description of the action set out in Annex 1.

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations in any EU grant may also lead to consequences in other EU grants awarded under similar conditions ('extension to other grants').

Moreover, findings arising from an OLAF or EPPO investigation may lead to criminal prosecution under national law.

25.5.2 Extension from other grants

Results of checks, reviews, audits or investigations in other grants may be extended to this grant, if:

- (a) the beneficiary concerned is found, in other EU grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — within the time-limit for audits set out in the Data Sheet (see Point 6).

The granting authority will formally notify the beneficiary concerned of the intention to extend the findings and the list of grants affected.

If the extension concerns **rejections of costs or contributions**: the notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings
- (b) the request to submit revised financial statements for all grants affected
- (c) the correction rate for extrapolation, established on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected, if the beneficiary concerned:
 - (i) considers that the submission of revised financial statements is not possible or practicable or
 - (ii) does not submit revised financial statements.

If the extension concerns **grant reductions**: the notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings and
- (b) the **correction rate for extrapolation**, established on the basis of the systemic or recurrent errors and the principle of proportionality.

The beneficiary concerned has **60 days** from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method/rate**.

On the basis of this, the granting authority will analyse the impact and decide on the implementation

(i.e. start rejection or grant reduction procedures, either on the basis of the revised financial statements or the announced/alternative method/rate or a mix of those; see Articles 27 and 28).

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 26 — IMPACT EVALUATIONS

26.1 Impact evaluation

The granting authority may carry out impact evaluations of the action, measured against the objectives and indicators of the EU programme funding the grant.

Such evaluations may be started during implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiaries and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent outside experts.

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

26.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the granting authority may apply the measures described in Chapter 5.

CHAPTER 5 CONSEQUENCES OF NON-COMPLIANCE

SECTION 1 REJECTIONS AND GRANT REDUCTION

ARTICLE 27 — REJECTION OF COSTS AND CONTRIBUTIONS

27.1 Conditions

The granting authority will — at beneficiary termination, interim payment, final payment or afterwards — reject any costs or contributions which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 25).

The rejection may also be based on the extension of findings from other grants to this grant (see Article 25).

Ineligible costs or contributions will be rejected.

27.2 Procedure

If the rejection does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the rejection, the amounts and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the rejection (payment review procedure).

If the rejection leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

27.3 Effects

If the granting authority rejects costs or contributions, it will deduct them from the costs or contributions declared and then calculate the amount due (and, if needed, make a recovery; see Article 22).

ARTICLE 28 — GRANT REDUCTION

28.1 Conditions

The granting authority may — at beneficiary termination, final payment or afterwards — reduce the grant for a beneficiary, if:

- (a) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or
- (b) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (see Article 25).

The amount of the reduction will be calculated for each beneficiary concerned and proportionate to the seriousness and the duration of the errors, irregularities or fraud or breach of obligations, by applying an individual reduction rate to their accepted EU contribution.

28.2 Procedure

If the grant reduction does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the reduction, the amount to be reduced and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the reduction (payment review procedure).

If the grant reduction leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

28.3 Effects

If the granting authority reduces the grant, it will deduct the reduction and then calculate the amount due (and, if needed, make a recovery; see Article 22).

SECTION 2 — SUSPENSION AND TERMINATION

ARTICLE 29 — PAYMENT DEADLINE SUSPENSION

29.1 Conditions

The granting authority may — at any moment — suspend the payment deadline if a payment cannot be processed because:

- (a) the required report (see Article 21) has not been submitted or is not complete or additional information is needed
- (b) there are doubts about the amount to be paid (e.g. ongoing audit extension procedure, queries about eligibility, need for a grant reduction, etc.) and additional checks, reviews, audits or investigations are necessary, or
- (c) there are other issues affecting the EU financial interests.

29.2 Procedure

The granting authority will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day the notification is sent.

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining time to pay (see Data Sheet, Point 4.2) will resume.

If the suspension exceeds two months, the coordinator may request the granting authority to confirm if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the report and the revised report is not submitted (or was submitted but is also rejected), the granting authority may also terminate the grant or the participation of the coordinator (see Article 32).

ARTICLE 30 — PAYMENT SUSPENSION

30.1 Conditions

The granting authority may — at any moment — suspend payments, in whole or in part for one or more beneficiaries, if:

- (a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or

- (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or
- (b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant.

If payments are suspended for one or more beneficiaries, the granting authority will make partial payment(s) for the part(s) not suspended. If suspension concerns the final payment, the payment (or recovery) of the remaining amount after suspension is lifted will be considered to be the payment that closes the action.

30.2 Procedure

Before suspending payments, the granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to suspend payments and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

At the end of the suspension procedure, the granting authority will also inform the coordinator.

The suspension will **take effect** the day after the confirmation notification is sent.

If the conditions for resuming payments are met, the suspension will be **lifted**. The granting authority will formally notify the beneficiary concerned (and the coordinator) and set the suspension end date.

During the suspension, no prefinancing will be paid to the beneficiaries concerned. For interim payments, the periodic reports for all reporting periods except the last one (see Article 21) must not contain any financial statements from the beneficiary concerned (or its affiliated entities). The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

ARTICLE 31 — GRANT AGREEMENT SUSPENSION

31.1 Consortium-requested GA suspension

31.1.1 Conditions and procedure

The beneficiaries may request the suspension of the grant or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 35) — make implementation impossible or excessively difficult.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the suspension takes effect; this date may be before the date of the submission of the amendment request and
- the expected date of resumption.

The suspension will **take effect** on the day specified in the amendment.

Once circumstances allow for implementation to resume, the coordinator must immediately request another **amendment** of the Agreement to set the suspension end date, the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the amendment. This date may be before the date of the submission of the amendment request.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during grant suspension are not eligible (see Article 6.3).

31.2 EU-initiated GA suspension

31.2.1 Conditions

The granting authority may suspend the grant or any part of it, if:

- (a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or
- (b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant
- (c) other:
 - (i) linked action issues: not applicable
 - (ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

31.2.2 Procedure

Before suspending the grant, the granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to suspend the grant and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

The suspension will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification).

Once the conditions for resuming implementation of the action are met, the granting authority will formally notify the coordinator a **lifting of suspension letter**, in which it will set the suspension end date and invite the coordinator to request an amendment of the Agreement to set the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the lifting of suspension letter. This date may be before the date on which the letter is sent.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during suspension are not eligible (see Article 6.3).

The beneficiaries may not claim damages due to suspension by the granting authority (see Article 33).

Grant suspension does not affect the granting authority's right to terminate the grant or a beneficiary (see Article 32) or reduce the grant (see Article 28).

ARTICLE 32 — GRANT AGREEMENT OR BENEFICIARY TERMINATION

32.1 Consortium-requested GA termination

32.1.1 Conditions and procedure

The beneficiaries may request the termination of the grant.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the consortium ends work on the action ('end of work date') and
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

The termination will **take effect** on the termination date specified in the amendment.

If no reasons are given or if the granting authority considers the reasons do not justify termination, it may consider the grant terminated improperly.

32.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Improper termination may lead to a grant reduction (see Article 28).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.2 Consortium-requested beneficiary termination

32.2.1 Conditions and procedure

The coordinator may request the termination of the participation of one or more beneficiaries, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing)
- the date the beneficiary ends work on the action ('end of work date')
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

If the termination concerns the coordinator and is done without its agreement, the amendment request must be submitted by another beneficiary (acting on behalf of the consortium).

The termination will **take effect** on the termination date specified in the amendment.

If no information is given or if the granting authority considers that the reasons do not justify termination, it may consider the beneficiary to have been terminated improperly.

32.2.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a **report on the distribution of payments** to the beneficiary concerned
- (ii) a **termination report** from the beneficiary concerned, for the open reporting period until

termination, containing an overview of the progress of the work, the financial statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

- (iii) a second **request for amendment** (see Article 39) with other amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the second request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the second request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

Improper termination may lead to a reduction of the grant (see Article 31) or grant termination (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.3 EU-initiated GA or beneficiary termination

32.3.1 Conditions

The granting authority may terminate the grant or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 40)
- (b) a change to the action or the legal, financial, technical, organisational or ownership situation of a beneficiary is likely to substantially affect the implementation of the action or calls into



question the decision to award the grant (including changes linked to one of the exclusion grounds listed in the declaration of honour)

- (c) following termination of one or more beneficiaries, the necessary changes to the Agreement (and their impact on the action) would call into question the decision awarding the grant or breach the principle of equal treatment of applicants
- (d) implementation of the action has become impossible or the changes necessary for its continuation would call into question the decision awarding the grant or breach the principle of equal treatment of applicants
- (e) a beneficiary (or person with unlimited liability for its debts) is subject to bankruptcy proceedings or similar (including insolvency, winding-up, administration by a liquidator or court, arrangement with creditors, suspension of business activities, etc.)
- (f) a beneficiary (or person with unlimited liability for its debts) is in breach of social security or tax obligations
- (g) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has been found guilty of grave professional misconduct
- (h) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed fraud, corruption, or is involved in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking
- (i) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) was created under a different jurisdiction with the intent to circumvent fiscal, social or other legal obligations in the country of origin (or created another entity with this purpose)
- (j) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.)
- (k) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 25)
- (l) despite a specific request by the granting authority, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its affiliated entities or associated partners that is in one of the situations under points (d), (f), (e), (g), (h), (i) or (j) and to reallocate its tasks, or

(m) other:

- (i) linked action issues: not applicable
- (ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

32.3.2 Procedure

Before terminating the grant or participation of one or more beneficiaries, the granting authority will send a **pre-information letter** to the coordinator or beneficiary concerned:

- formally notifying the intention to terminate and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the termination and the date it will take effect (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

For beneficiary terminations, the granting authority will — at the end of the procedure — also inform the coordinator.

The termination will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification; ‘termination date’).

32.3.3 Effects

(a) for **GA termination**:

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the last open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

If the grant is terminated for breach of the obligation to submit reports, the coordinator may not submit any report after termination.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Termination does not affect the granting authority’s right to reduce the grant (see Article 28) or to impose administrative sanctions (see Article 34).

The beneficiaries may not claim damages due to termination by the granting authority (see Article 33).



After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

(b) for **beneficiary termination**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a **report on the distribution of payments** to the beneficiary concerned
- (ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)
- (iii) a **request for amendment** (see Article 39) with any amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

SECTION 3 OTHER CONSEQUENCES: DAMAGES AND ADMINISTRATIVE SANCTIONS

ARTICLE 33 — DAMAGES

33.1 Liability of the granting authority

The granting authority cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of the implementation of the Agreement, including for gross negligence.

The granting authority cannot be held liable for any damage caused by any of the beneficiaries or other participants involved in the action, as a consequence of the implementation of the Agreement.

33.2 Liability of the beneficiaries

The beneficiaries must compensate the granting authority for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement, provided that it was caused by gross negligence or wilful act.

The liability does not extend to indirect or consequential losses or similar damage (such as loss of profit, loss of revenue or loss of contracts), provided such damage was not caused by wilful act or by a breach of confidentiality.

ARTICLE 34 — ADMINISTRATIVE SANCTIONS AND OTHER MEASURES

Nothing in this Agreement may be construed as preventing the adoption of administrative sanctions (i.e. exclusion from EU award procedures and/or financial penalties) or other public law measures, in addition or as an alternative to the contractual measures provided under this Agreement (see, for instance, Articles 135 to 145 EU Financial Regulation 2018/1046 and Articles 4 and 7 of Regulation 2988/95²²).

SECTION 4 FORCE MAJEURE

ARTICLE 35 — FORCE MAJEURE

A party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

‘Force majeure’ means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties’ control,
- was not due to error or negligence on their part (or on the part of other participants involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

²² Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

CHAPTER 6 FINAL PROVISIONS

ARTICLE 36 — COMMUNICATION BETWEEN THE PARTIES

36.1 Forms and means of communication — Electronic management

EU grants are managed fully electronically through the EU Funding & Tenders Portal ('Portal').

All communications must be made electronically through the Portal, in accordance with the Portal Terms and Conditions and using the forms and templates provided there (except if explicitly instructed otherwise by the granting authority).

Communications must be made in writing and clearly identify the grant agreement (project number and acronym).

Communications must be made by persons authorised according to the Portal Terms and Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in their appointment letter (see Portal Terms and Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Portal.

36.2 Date of communication

The sending date for communications made through the Portal will be the date and time of sending, as indicated by the time logs.

The receiving date for communications made through the Portal will be the date and time the communication is accessed, as indicated by the time logs. Formal notifications that have not been accessed within 10 days after sending, will be considered to have been accessed (see Portal Terms and Conditions).

If a communication is exceptionally made on paper (by e-mail or postal service), general principles apply (i.e. date of sending/receipt). Formal notifications by registered post with proof of delivery will be considered to have been received either on the delivery date registered by the postal service or the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

36.3 Addresses for communication

The Portal can be accessed via the Europa website.

The address for paper communications to the granting authority (if exceptionally allowed) is the official mailing address indicated on its website.

For beneficiaries, it is the legal address specified in the Portal Participant Register.

ARTICLE 37 — INTERPRETATION OF THE AGREEMENT

The provisions in the Data Sheet take precedence over the rest of the Terms and Conditions of the Agreement.

Annex 5 takes precedence over the Terms and Conditions; the Terms and Conditions take precedence over the Annexes other than Annex 5.

Annex 2 takes precedence over Annex 1.

ARTICLE 38 — CALCULATION OF PERIODS AND DEADLINES

In accordance with Regulation No 1182/71²³, periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

‘Days’ means calendar days, not working days.

ARTICLE 39 — AMENDMENTS

39.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

39.2 Procedure

The party requesting an amendment must submit a request for amendment signed directly in the Portal Amendment tool.

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3). If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why
- the appropriate supporting documents and

²³ Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8/6/1971, p. 1).

- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The granting authority may request additional information.

If the party receiving the request agrees, it must sign the amendment in the tool within 45 days of receiving notification (or any additional information the granting authority has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date of entry into force or other date specified in the amendment.

ARTICLE 40 — ACCESSION AND ADDITION OF NEW BENEFICIARIES

40.1 Accession of the beneficiaries mentioned in the Preamble

The beneficiaries which are not coordinator must accede to the grant by signing the accession form (see Annex 3) directly in the Portal Grant Preparation tool, within 30 days after the entry into force of the Agreement (see Article 44).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 44).

If a beneficiary does not accede to the grant within the above deadline, the coordinator must — within 30 days — request an amendment (see Article 39) to terminate the beneficiary and make any changes necessary to ensure proper implementation of the action. This does not affect the granting authority's right to terminate the grant (see Article 32).

40.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 39. It must include an accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool.

New beneficiaries will assume the rights and obligations under the Agreement with effect from the date of their accession specified in the accession form (see Annex 3).

Additions are also possible in mono-beneficiary grants.

ARTICLE 41 — TRANSFER OF THE AGREEMENT

In justified cases, the beneficiary of a mono-beneficiary grant may request the transfer of the grant to a new beneficiary, provided that this would not call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiary must submit a request for **amendment** (see Article 39), with

- the reasons why
- the accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool and
- additional supporting documents (if required by the granting authority).

The new beneficiary will assume the rights and obligations under the Agreement with effect from the date of accession specified in the accession form (see Annex 3).

ARTICLE 42 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE GRANTING AUTHORITY

The beneficiaries may not assign any of their claims for payment against the granting authority to any third party, except if expressly approved in writing by the granting authority on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the granting authority has not accepted the assignment or if the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the granting authority.

ARTICLE 43 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

43.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

Special rules may apply for beneficiaries which are international organisations (if any; see Data Sheet, Point 5).

43.2 Dispute settlement

If a dispute concerns the interpretation, application or validity of the Agreement, the parties must bring action before the EU General Court — or, on appeal, the EU Court of Justice — under Article 272 of the Treaty on the Functioning of the EU (TFEU).

For non-EU beneficiaries (if any), such disputes must be brought before the courts of Brussels, Belgium — unless an international agreement provides for the enforceability of EU court judgements.

For beneficiaries with arbitration as special dispute settlement forum (if any; see Data Sheet, Point 5), the dispute will — in the absence of an amicable settlement — be settled in accordance with the Rules for Arbitration published on the Portal.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 22 and 34), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice — under Article 263 TFEU.

For grants where the granting authority is an EU executive agency (see Preamble), actions against



offsetting and enforceable decisions must be brought against the European Commission (not against the granting authority; see also Article 22).

ARTICLE 44 — ENTRY INTO FORCE

The Agreement will enter into force on the day of signature by the granting authority or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the granting authority



ANNEX 1



Horizon Europe (HORIZON)

Description of the action (DoA)

Part A

Part B

DESCRIPTION OF THE ACTION (PART A)

COVER PAGE

Part A of the Description of the Action (DoA) must be completed directly on the Portal Grant Preparation screens.

PROJECT	
Grant Preparation (General Information screen) — Enter the info.	
Project number:	101180124
Project name:	Hybrid Virtualized Testing for Certification of EGNSS in Railway Train Positioning
Project acronym:	VICE4RAIL
Call:	HORIZON-EUSPA-2023-SPACE
Topic:	HORIZON-EUSPA-2023-SPACE-01-42
Type of action:	HORIZON-IA
Service:	EUSPA/MKD
Project starting date:	first day of the month following the entry into force date
Project duration:	36 months

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PROJECT SUMMARY

Project summary

Grant Preparation (General Information screen) — Provide an overall description of your project (including context and overall objectives, planned activities and main achievements, and expected results and impacts (on target groups, change procedures, capacities, innovation etc)). This summary should give readers a clear idea of what your project is about.

Use the project summary from your proposal.

VICE4RAIL aims to accelerate the adoption of EGNSS for deploying efficient, resilient, and competitive ERTMS solutions. Focus is on the development of a certification and standardization process for the use of EGNSS, closing the gaps for rail safety critical applications and converging towards a pan-European EGNSS-based solution for ERTMS and its global roll-out. The starting point is the use of EGNOS V2 and the Balise virtualisation – as indicated by the European Parliament directive on July 2021 – opening the way for further applications based on the absolute train positioning and EGNOS V3. Two major developments will be undertaken: identification of suitable certification procedures compliant with the CENELEC norms and realization of a Hybrid Virtualized Testing Certification Environment based on the zero-on-site testing paradigm with the construction of a dedicated testing facility on a RFI’s railway lines where GNSS-based multisensor positioning solutions can be evaluated and certified in operational scenarios. This unique testing environment will be connected with the ERTMS accredited laboratory of CEDEX to assess the end-to-end performance of the ERTMS chain with GNSS-based positioning devices in operational scenarios. Behaviour of the system under GNSS signals that include faults very rare and difficult to experience field but with a potential high impact on safety, can be evaluated avoiding extensive and not exhaustive field tests. VICE4RAIL will exploit the synergies with the Pilot Line Novara – Rho funded by RFI to integrate GNSS positioning into the ERTMS and the Shift2Rail GATE4Rail project that introduced the zero-on-field virtual testing for GNSS. Furthermore, thanks to SNCF, CEDEX, RFI and SOGEI a liaison will be established with the Europe’s Rail R2DATO project to complement their on-going activities and sharing results and assets and with the RTCM SC 134 Special Committee that is completing the standardization process for GNSS receivers for rail.

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	RFI	RETE FERROVIARIA ITALIANA	IT	999434360
2	BEN	RDL	CONSORZIO UNIVERSITA INDUSTRIA - LABORATORI DI RADIOCOMUNICAZION I	IT	999585971
3	BEN	ITCF	ITALCERTIFER SOCIETA PER AZIONI	IT	996654340
4	BEN	BVI	BUREAU VERITAS ITALIA SPA	IT	913300300
5	BEN	CEDEX	CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS	ES	999455312
6	BEN	UPCE	UNIVERZITA PARDUBICE	CZ	999453663
7	BEN	UNI EIFFEL	UNIVERSITE GUSTAVE EIFFEL	FR	897556521
8	BEN	SGI	SOGEI-SOCIETA GENERALE D'INFORMATICA SPA	IT	949108723
9	BEN	SNCF	SOCIETE NATIONALE SNCF	FR	999941767
9.1	AE	SNCF VOYAGEURS	SNCF VOYAGEURS	FR	893626081

LIST OF WORK PACKAGES

Work packages <i>Grant Preparation (Work Packages screen) — Enter the info.</i>						
Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
WP1	Project Management and Coordination	1 - RFI	36.00	1	36	D1.1 – D1.1 Project and Risk management Plan D1.2 – D1.2 Data Management Plan
WP2	Hybrid Virtualized Testing Certification Environment Requirements/ Development of certification plan	6 - UPCE	39.00	1	10	D2.1 – D2.1 Rail user & system requirements D2.2 – D2.2 Risk Analysis Evaluation report D2.3 – D2.3 Certification Plan D2.4 – D2.4 Synergies in the certification process for use in multimodal transport
WP3	Reference Architecture Design	8 - SGI	52.00	9	19	D3.1 – D3.1 Overall Architecture Design Document D3.2 – D3.2 Detailed Design Document D3.3 – D3.3 System Requirement Document D3.4 – D3.4 Test Plan
WP4	Hybrid Virtualized Testing Certification Environment Development	2 - RDL	66.00	18	29	D4.1 – D4.1 Procurement List Document D4.2 – D4.2 Development Report D4.3 – D4.3 Test Report
WP5	Certification process	4 - BVI	60.00	26	36	D5.1 – D5.1 Validation Strategies D5.2 – D5.2 Certification on Board subsystem D5.3 – D5.3 Certification on track subsystem and related system integration

Work packages						
Grant Preparation (Work Packages screen) — Enter the info.						
Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverables
WP6	Dissemination, Exploitation and Communication Objectives	2 - RDL	30.00	1	36	D6.1 – D6.1 Dissemination Exploitation and Communication plan D6.2 – D6.2 Dissemination, Exploitation and Communication Report

Work package WP1 – Project Management and Coordination

Work Package Number	WP1	Lead Beneficiary	1 - RFI
Work Package Name	Project Management and Coordination		
Start Month	1	End Month	36

Objectives

- ensure efficient coordination of the project.
- coordinate WPs' activities to maintain alignment with the general objectives of the project.
- coordinate the transfer of information from external projects and initiatives.
- to ensure efficient management of common consortium activities.
- ensure efficient overall administrative and financial management of the project.
- manage internal and external communication, evaluating and reporting progress to the EC and partners.
- perform risk management, defining risk mitigation strategies to achieve complete project objectives on time.
- to ensure compliance with the "ethical requirements" that the project must respect.
- guide the consortium in the correct application of the standards and recommendations foreseen for the different operational contexts.

Description**T1.1: Project & consortium management**

Project Coordination activities will be undertaken by RFI, with the support of RDL. RFI will be responsible for the overall project strategy implementation including project planning, performance and financial control, quality assurance, risk management, contingency planning, and administration of the EU funding.

RFI, supported by RDL will be responsible for:

- the overall project strategy implementation including project organising, planning, and scheduling.
- deliver all deliverables to the EC in due date.
- the coordination between the consortium partners through the sharing of technical and financial information.
- define and implement the Data Management Plan.
- ensure that publications have been shared in Open Access

RFI, with RDL support, will be also responsible for the Consortium management:

- maintenance of the Consortium Agreement.
- preparing and post-processing of official project meetings as set out in the Consortium Agreement, as well as of reviewing meetings with the European Commission.
- distribution of deliverables and reports and maintenance of a project archive in the form of a document repository (EMDESK tool).

T1.2: Technical coordination

The technical coordination will oversee monitoring the technical development of all technical tasks in the project. The Technical Leader will ensure alignment of work and consistency across WPs in the deliverables so that the global objectives of the project are ensured. The Technical Management Team (TMT), composed by the Technical Leader (RFI) and the WP leaders oversees monitoring the technical progress of all technical tasks within the project. To this end, the TMT is devoted to:

- provide scientific guidance, manage conflicts, and take final decisions as necessary.
- conduct review(s) of the specific work being carried out by the work packages, verify status and progress, control results and capture and/or implement changes to the work plan, milestones and status indicators.
- monitor the relations between the WPs.
- monitor the progress of Milestones/Deliverables technical results against the objectives.
- identify and manage technical issues.

Meetings are planned at project milestones; periodic conference calls will be scheduled. For each meeting or call will include a clear and concise agenda and Minutes of Meetings (MoM) with clear actions to be followed up.

T1.3: Administrative & financial management

This task is devoted to:

- support the partners in carrying out the administrative and financial requirements corresponding to the contractual obligations towards the EC.
- ensure that all the appropriate payments are made without unjustified delay.
- perform management of the administrative aspects all along the project.
- implement and maintain an internal costs controlling tool updated in case of any budget amendments.
- designing and maintaining specific templates for collecting input to the financial, periodic, and final reports and deliverables.

Work package WP2 – Hybrid Virtualized Testing Certification Environment Requirements/ Development of certification plan

Work Package Number	WP2	Lead Beneficiary	6 - UPCE
Work Package Name	Hybrid Virtualized Testing Certification Environment Requirements/ Development of certification plan		
Start Month	1	End Month	10

Objectives

- Specification of user, functional, system safety and security requirements for the HyVICE assessment, design, validation and certification plan specification.
- Development of the industry-accepted certification schemes for the HyVICE.
- Comparison and assessment of certification procedures in rail, automotive and maritime sectors to identify common features and elements of the certification schemes to make

The certification of multimodal solutions (especially SBAS SoL service and GNSS local augmentation integrity monitoring network) more efficient - faster and cheaper.

The requirements are needed for HyVICE design, implementation, validation of its correct functioning and certification for multimodal transport applications, where the HyVICE is considered as a new interoperability constituent. The system requirements specifications will start from the VICE4RAIL CONOPS (Concept of Operations) used to define and justify high-level user requirements for rail, automotive and maritime safety applications. The conclusions from the previous projects such as HELMET, ERSAT GGC, GATE4RAIL, STARS, ESA STEMS, EMERGE, R2DATO etc., and results from GNSS User Consultation Platforms (UCP) organised by EUSPA will be considered as well. The most challenging operational scenarios in terms of accuracy and integrity for the GNSS sub-system will be selected and the high-level user requirements for VICE4RAIL solution will be specified and justified in more detail. Since VICE4RAIL should provide a common virtualized testing solution for safety applications in the multi-modal transport (rail, automotive and maritime), a great emphasis is placed on the use of synergies between these transport modes, as well as appropriate techniques to harmonise requirements.

The development of a certification plan for virtualised GNSS-based positioning testing within VICE4RAIL will build on the well-established certification process on European railways, as defined in Interoperability directives and regulations, where the certification process ensures that all essential ERTMS requirements for safety and interoperability specified in TSIs (Technical Specifications for Interoperability) are met. It will also be possible to evaluate, if applicable, the evidence contained in the result of the certification for the safe integration of ERTMS with the aeronautical SBAS SoL service (SBAS SoL considered as a “pre-existing” element in the sense of IEC 61508 and EN 50129 as it was proposed in the ESA STEMS project).

Finally, the certification processes in rail, automotive and maritime transport will be compared to specify proposals for efficient certification solution for multimodal transport (not only for rail). This will be done by UPCE and UNI EIFFEL and other WP2 participants will also contribute.

The requirement fixation and certification plan will be carried out by BVI/ITCF as Notified Body by issuing Technical Note and a preliminary certification plan.

Description

T2.1: Rail user & system requirements

This task is devoted to rail user and system requirements for VICE4RAIL Hybrid Virtualized Testing Certification Environment (HyVICE). Main attention is focused on use of HyVICE for ERTMS virtual balise detection using GNSS.

Well-developed procedures will be used to derive harmonised requirements used on European railways to guarantee both interoperability and transport safety. Input for the derivation of the railway requirements will also be the outputs of the ERSAT GGC, RHINOS, GATE4RAIL, HELMET, EUSPA UCP, ERJU R2DATO and ESA projects. The derivation of railway requirements for VICE4RAIL HyVICE will consider the following main activities:

- development/ update of user requirements using railway CONOPS,
- preliminary system definition,
- hazard identification and classification,
- use of Risk Acceptance Principles (RAP) – namely Code of Practice (CoP),
- risk analysis and high-level system safety and security requirements specification,
- requirements final definition.

Appropriate RAP, in particular CoP, such as CENELEC standards, ERTMS TSIs, etc. will be used to harmonise safety requirements. Task T2.1 will contribute to the specification of railway requirements for virtualised testing and certification of ERTMS based on GNSS. VICE4RAIL will consider as input also the general requirements for a common virtual certification process and the operational needs for absolute safe train positioning systems from R2DATO project.

T2.2: Development of the certification plan for the VICE4RAIL solution

The objectives of this task are (1) to fix the requirements, (2) to develop a TSI certification plan and (3) to initially consolidate the certification process of the VICE4RAIL test platform for safe train positioning for ERTMS/ETCS virtual balise detection. To achieve the requirements fixation, the Common Safety Method for Risk evaluation (at system level) Assessment (“CSM-RA”) according to the regulation (EU) 402/2013 for harmonisation of risk assessment, will be applied. The requirement fixation will be the basis to demonstrate compliance and related certification of conformity, with detail to the new requirements defined in relation to the ERTMS virtual balise approach.

T2.3: Synergies between rail, automotive and maritime in the certification process

The aim of this task is to compare and assess certification procedures in rail, automotive and maritime sectors to identify common elements of the certification schemes to make the certification of multimodal solutions faster and cheaper. It includes the following activities:

- Harmonisation of high-level system requirements for VICE4RAIL HyVICE for GNSS based vehicle positioning with safety applications in the rail, automotive and maritime sectors. The harmonisation will be based on long-standing experience on railways with broadly acceptable risk acceptance criteria such as code of practice, similar reference systems and explicit risk estimation as a part of EN 50126-1:2017 and CSM-DT.
- Comparative analysis of railway EN 50126 (RAMS), automotive ISO/TR 4804 (dependability), IEC 60600-1 (generic dependability) and other related standards to clarify differences between railway and automotive safety concepts and reveal impacts on the V&V and certification process.
- Analysis of the automotive SOTIF concept and its potential use in certification process of GNSS-based train positioning. The purpose of SOTIF is to mitigate: 1) risk due to unexpected operating conditions including incorrect user behaviour, and 2) insufficiencies in requirements specifications. For this analysis the ISO/PAS 21448 (SOTIF) standard will be utilised.
- Examining the importance of GNSS continuity for positioning and certification in multimodal transport (rail, road) since the applicability of continuity has not been sufficiently investigated in these fields. The aim of this activity is to close this gap by clarifying: 1) where the requirement for GNSS continuity comes from, 2) why GNSS continuity is needed in land transport, and 3) how GNSS-based applications can be made more reliable when needed.

Task T2.3 will contribute to the certification of common elements in GNSS-based positioning to make the certification of multimodal transport solutions more efficient.

In this WP, BVI has foreseen the support of an external consultant in the tasks of support to project coordination and management for the preparation of Certification plan with an effort of about 1 man-month.

Work package WP3 – Reference Architecture Design

Work Package Number	WP3	Lead Beneficiary	8 - SGI
Work Package Name	Reference Architecture Design		
Start Month	9	End Month	19

Objectives

The design of the Overall and Detailed Architecture for the Test Platform, based on Field Testing and Virtualise Simulation Platform, is developed.

Description

HyVICE is composed by:

- Real Testing Platform: (GNSS Augmentation System, Communication System, DUT Emulator)
- Laboratory Testing Platform (Rail Signal Simulator, Rail Track Simulator)

The overall system is designed to support different train localization system implementation. The Overall and Detailed Design Architecture is designed. The maximum reuse of existing infrastructure, simulators and relevant interfaces is taken as a design driver. Existing Communication and sectorial Standards are used as much as possible to improve the coverage of the solutions. The following Tasks are carried out.

T3.1 – Overall Architecture Design and System Requirements definition

Starting from the analysis of the User Requirements defined into WP2, the System Requirements and Overall Architecture of HyVICE is designed.

The functional decomposition of the overall system for the full chain is carried out and relevant interfaces identified. The following aspects will be integrated:

- Integration of the designed systems within ETCS and full chain testing modelling
- Integration of existing functional and ERTMS and PVT simulation tools
- Definition of the tools for the implementation of the Certification Path for the Functional and Safety. Verification path, based on available simulation tools
- Interoperability with Odometry and the other available Rail On-Board IMU Sensors
- Local Effects modelling

Main functional architectural blocks for the HyVICE platform are defined, including the GNSS Augmentation System, Rail Operator infrastructures, Communication System and Laboratory Testing Platform. The Overall Architecture Design document and the System Requirements Documents are issued.

The Task Leader is responsible for D3.1 and D3.3.

T3.2 – Sensor Error Simulation Model Design

A review of the state of the art of GNSS-based positioning solutions developed for Rail applications and ETCS is carried out to identify the simulation platform blocks required and beside to be developed in the project for simulation. These blocks shall represent the context of use of the testing platform that will impact sensors, thus system behaviour: train trajectory, environments crossed and their effects on the embedded sensors (for positioning), dynamic of the vehicle and information required by the ERTMS OB. Special tasks will be devoted to local effects modelling: from state of the art of existing error models, complementary investigations will be carried out, investigating the use and opportunity to use 3D models and ray tracing as a complementary datadriven modelling solution that is developed in R2DATO. The task members provide contributions to the D3.1 and D3.3 relevant to the task objective.

T3.3 – Detailed Architecture Design – GNSS Augmentation System

The design of a Generalized Augmentation System, able to provide different augmentation services adopted by single Countries, based on DGNSS, RTK and SBAS, for High Accuracy and High Integrity services, is designed for the purpose of the HyVICE implementation. Starting from the selected location for the Mixed Reality Testing Platform, a Reference Station Network is designed around the testing area. The selection of the sites and the monumentation system for Reference Station installation is carried out and implementation constraints identified. The algorithm for a generalized High Integrity Monitoring system is based on the integration of SBAS, DGNSS and RTK, following the 2-Tiers approach and relevant evolutions (e.g. HELMET project). Furthermore, the monumentation system is designed for the Reference Station installation. The upgrade of the Sogei GRDNet (GNSS R&D Network) infrastructure, to be reused for the scopes of the Project, is designed in order to develop within WP 4 the Augmentation System. RTCM SC 104 is used for High Accuracy Augmentation message formatting and the available RTCM SC 134 version for Integrity Parameters transmission. The Interface Design is carried out, as contribution to the Detailed Design Document.

The task members provide contributions to the D3.2, D3.3 and D3.4 relevant to the task objective.

Task 3.4 – Detailed Architecture Design – Communication System

The Communication System for the HyVICE is designed for the following functions:

- Reference Stations to GNSS Augmentation Control Centre
- GNSS Augmentation Control Centre to On-Board Localizer

The standard RTCM SC104 NTRIP protocol is used for real-time GNSS raw measurement collection at Control Centre side.

The task members provide contributions to the D3.2, D3.3 and D3.4 relevant to the task objective.

Task 3.5 - Detailed Architecture Design – Laboratory Testing Platform

This is Laboratory Train Positioning Testing Design, with the following functionalities:

- GNSS Signal Simulator
- Rail Track Simulator
- RBC Simulator
- GSM-R Simulator
- DUT (EVC including the Train Positioning Module)
- Track Trajectory Simulator

Relevant Interfaces between architectural components for ERTMS implementation are designed. The proposed architecture follows the scheme in Figure 5.

Interfaces between the DUT and the GNSS Augmentation System are designed.

The task members provide contributions to the D3.2, D3.3 and D3.4 relevant to the task objective.

Task 3.6 – Detailed Architecture Design – Real Testing Platform

Based on the System Requirements and Interface definition and the designed Certification Methodology, the HyVICE, based on On-field measurements and the identified Simulation tools, is designed. The Data Management System is designed. The task members provide contributions to the D3.2, D3.3 and D3.4 relevant to the task objective.

Work package WP4 – Hybrid Virtualized Testing Certification Environment Development

Work Package Number	WP4	Lead Beneficiary	2 - RDL
Work Package Name	Hybrid Virtualized Testing Certification Environment Development		
Start Month	18	End Month	29

Objectives

The main objectives of WP4 are the development of the system designed in WP3 and in particular:

- Procurement of tools, hardware, and services required for the HyVICE Development
- Development of subsystem components defined in WP3
- System integration and testing based on test plan and test procedures defined in WP3
- Laboratory and on-field test execution

Description

T4.1 Procurement of tools, hardware, and services

The main objective of this task is the procurement of the full set of hardware, software and services needed by HyVICE implementation. The following sub-tasks have been identified:

- Definition of a list of candidate COTS Hardware meeting the requirements, also considering the possibility of reusing partners' existing tools, to reduce procurement cost
- Procurement of Hardware, Software and Services.
- Identification of the Engine (locomotive) to be equipped and setup of the logistic plan for starting the provision.

T4.2 - Development of subsystem components

This task is devoted to the development of each subsystem component and of the testing interfaces. It includes:

- Development of the Communication system interconnecting the HyVICE components
- Adaptation and extension of HELMET AIMN to fulfil the HyVICE needs.
- Adaptation and extension of the VIRGILIO simulator to fulfil the HyVICE needs.
- Development of a baseline train positioning emulator to be used as DUT emulator to assess the compliance of the HyVICE implementation to the HyVICE requirements.
- Adaptation and extension of the CEDEX ERTMS architecture to fulfil the HyVICE needs.
- Development of the required interfaces for context influence considerations on the positioning sensors and algorithms. Local effects will be generated by procured tools (GNSS signal generators with modified parameterization coming from error models or 3D models).
- HyVICE deployment at the Real testing Platform including:

- o Identification of the Engine (locomotive) to be equipped and setup of the logistic plan for starting the process.
- o Installation of the HyVICE equipment on board the train
- o GNSS Augmentation System deployment
- o Installation of the wayside HyVICE equipment for train ground truth

T4.3 System integration

This task is devoted to the final system integration for both the Real and the Laboratory testing platforms. It includes:

- Unit testing. Each developed module will be tested against the established requirements. Unit tests will be carried out at algorithm level and/or using the outputs from the platform itself. The test results will be collected in a test report
- Interface testing
- System integration testing
- The DUT (EVC including Train Positioning Module) to be integrated at CEDEX laboratory, according to the architecture shown in Figure 5.

T4.4 Test Scenarios Definition

This task will be devoted to the concrete definition of the test scenarios to be executed on field and at lab:

- Definition of EGNSS Scenarios
- Definition of ERTMS Scenarios to be run on field and at lab.

T4.5 On-field tests execution

- This task is devoted to the test execution on the Real Testing Platform. It includes the following activities: On field tests execution and recording according to the test plan defined in T4.4.
- On field tests results will be collected in a test report
- Sequential on field testing. Field tests will be organized in batch. After execution of each batch, detection of eventual critical anomalies will be performed and HyVICE revised as necessary. Each batch will include:

- o Field measurement and data collection
- o Data post-processing and analysis of field data

T4.6 Laboratory ERTMS tests execution

This task is devoted to the test execution on the Laboratory Testing Platform. It includes the following activities:

- Laboratory ERTMS tests execution and recording according to the test plan defined in T4.4. Laboratory tests results will be collected in the test report
- CEDEX will test at lab the same DUT (EVC including Train Positioning Module) tested previously in task 4.5. Task 4.5 leader will manage the delivery of this unit to CEDEX.
- Comparison and analysis between the On-field test recorded in T4.6 and lab test executed and recorded in this task.
- Validation of the lab based in the previous comparison between on field and lab tests

Work package WP5 – Certification process

Work Package Number	WP5	Lead Beneficiary	4 - BVI
Work Package Name	Certification process		
Start Month	26	End Month	36

Objectives

- Conformity Certification of the VICE4RAIL architecture to evaluate its full compliance with all applicable standards and norms, listing the possible “open points” related to the differences between the standard ERTMS and the “new” one and verifying the solution applied them. The evaluation will be submitted to the Safety Agency for its comments.

- Description and execution of a full simulated certification acquiring, also, useful elements from the ISA activity that ITCF will carry out in the experimentation of the virtual balises and of the augmentation network that RFI is implementing on the Novara Rho line.

To verify this possibility to use the GNSS in the ERTMS/ETCS, anyway preserving the CCS On Board interoperability with the existing one and the same (or better...) level of safety, several studies and pilot projects have been launched, some already concluded, some still ongoing, which have proven the technical feasibility of the integration of a GNSS locator in the standard platform ETCS. As any safety-related railway system, before entering service, also this new solution of ERTMS/ ETCS must be certified, by performing the planned process and applying the foreseen standards and by modifying or implementing what is necessary to consider the introduction of GNSS for train localization. As mentioned, the new ETCS is foreseen to evaluate the train position function by using the satellite constellations. It is mandatory to evaluate possible added risks coming from this new situation and to eliminate/ reduce them as foreseen from the rail safety criteria. The preliminary identification of the new requirements (among the whole set of the identified requirements)

for certification process that arises from the introduction of the GNSS in ETCS and of the gap with the physical balises by identifying the elements that an AsBo and No.Bo needs for CE certification has to be realized. These steps involve activities of design, construction, and testing. These activities are related to the following main topics: technical requirements definition, impact on the exiting requirements, detail on guideline for the configuration process defined by applicant/manufacture, detail on certification procedures, application of the above-mentioned activities to a real case to demonstrate the applicability. No.Bo is involved, according to his accredited role, to simulate a possible full certification process.

Description**T5.1 Validation Strategies**

The scope of this Task is to conduct the final validation of the system track side/on board based on activities related to Virtual Testing Platform and on track tests (Manufacturer/Applicant) for the Trackside and On Board, to verify the compliance of the system vs the TSI and the new requirements; furthermore, the scope is to conduct the On Board-Trackside integration test (Manufacturer/Applicant). Being a development research project, the validation phase is limited to define the validation strategies and to issue a draft or a simple template of main validation documents/ evidence.

T5.2 Assessment strategies versus Essential Requirements

The scope of this Task is to evaluate the conformity of the Essential Requirements in relation to the validation activities performed in the previous tasks:

- Safety (AsBo results as input for No.Bo.),
- Reliability and availability (taking in charge certificated products),
- Human health and environmental protection (not impacted by the change of the new system),
- Technical compatibility and operation of the system (TSI compliance evaluated by No.Bo developed in the following task).

T5.3 Assessment strategies versus Technical Compatibility

The scope of this Task is to assess the technical compatibility performed by ITCF for trackside and BVI for the On Board equipment (receiver and antenna) in relation to the validation activities delivered k through the following main activities:

- Analysis of the requirement matrix for TSI issued by the applicant/ manufacturer; Requirement matrix approval;
- Issuing of the Technical Notes containing findings about deviations from standards (if any);
- Examination of the project conformity;
- Performing technical audit;
- Test witnessing for the construction phase and for the test on field into the circuit of Bologna San Donato;
- Issuing of the system report and certificate based on the SG (track side) SB+SD (or SF) on board side according module (713/2010 EU) applicable in relation to the validation evidence performed.

In this WP, BVI has foreseen the support of an external consultant in the tasks related to project management and coordination, support to technical documentation evaluation and test witnessing with an effort about 1 Man-month

Work package WP6 – Dissemination, Exploitation and Communication Objectives

Work Package Number	WP6	Lead Beneficiary	2 - RDL
Work Package Name	Dissemination, Exploitation and Communication Objectives		
Start Month	1	End Month	36

Objectives

The main objective of WP6 is the dissemination and exploitation of results achieved within the VICE4RAIL project by managing external communication with recognised forums and communities targeted mainly to rail signalling manufacturers, regulators and authorities, space sector experts, rail infrastructure managers and operators. The main objectives of this WP are:

- to raise awareness and get feedback about the VICE4RAIL results in the railway and in the satellite communities.
- to promote VICE4RAIL among the standardisation and certification bodies, safety agencies and other decision-making entities.
- to share know-how among researchers and provide further opportunities for cooperation.
- to secure the involvement of important users and stakeholders.
- to engage with end users and wider stakeholder communities.
- to promote VICE4RAIL within GNSS conferences and workshops.
- to organise events and carry out dissemination activities toward institutional actors

Description

T6.1. Dissemination, Exploitation and Communication Plan

In the early stages of the project, a detailed dissemination and exploitation plan will be prepared. It will define the objectives and strategy for the dissemination of the project as well as the dissemination tools and the schedule of the foreseen activities. The Dissemination Plan will be periodically updated. The following activities are foreseen.

- Draft communication and dissemination strategy, outlining public and private target groups, communication tools, and dissemination channels at the European, national and local level.
- Development of project identity and logo, templates and set of PowerPoint slides that summarize the project for various target groups.
- Develop project website, presenting project objectives and ambition, (expected) results and partners.
- Develop a brochure summarizing the key project objectives. It will be produced by RDL and made available both in an electronic format and printed and distributed via the networks offered by the project partners. It will be distributed at M5.

T6.2 Dissemination, Exploitation and Communication activities

This task aims to actively engage with industry, academia, end-users, and EUSPA, leveraging associations' extensive dissemination channels. We will manage interactions with stakeholders in the rail and space sectors to effectively communicate the progress and outcomes of the VICE4RAIL project. Strategic engagement with beneficiaries and stakeholders will be prioritized to maximize impact. Technical work package leaders will contribute content for a knowledge base to be distributed among the target audience. The following activities have been identified:

- Formulation of 3 yearly newsletters (M12, M24, M30): VICE4RAIL developments, news and most attractive results will be included in three newsletters that will be distributed (paper / electronically) via the consortium partners. The participating network, along with the rest of the partners will ensure the wide dissemination of the newsletters and hence of the project developments.
- Existing stakeholders, networks: the aim is to promote the project and its findings through industry association partners, who use their own networks to convey project messages to their respective (inter) national and local members.
- Social Media: to show the characteristics and results of the project and leverage the benefits of R&D public funding policies to a wider audience, as well as to boost the engagement with this audience, a presence in social media is foreseen.

This task will define the content and coordinate the communication activities in social media, relying on the existing social media accounts of the project partners to maximize the impact.

Project events

Two workshops will be organized in the framework of the Project aiming to inform and get feedback from all interested parties on the achieved outcomes and results: one will be organized at M18 and one at the end of the project, a dedicated final event (M35) events organised by RDL. Press releases will be published after all public events.

Participation in European and International Conferences

The attendance on high-level events and conferences will be used as an effective tool to get in touch with the relevant stakeholders during the major events and to create awareness about the project and its main objectives.

Participation to RTCM SC-134.

The results of the project are shared within the RTCM SC-134 Special Committee through the Chairman of the whole Committee and the WG 2 Chairman.

RTCM SC-134, as a horizontal organisation, provides Data Fields and Messages for the development of High Accuracy and High Integrity services from User, Service Providers, Academic and Manufacturer point of view.

Standardised Basic Messages are used as much as possible within the platform, to favourite a penetration of VICE4RAIL solution.

To address the Rail community requirements, comments about RTCM SC-134 Data Field and messages, derived from the on-field test and simulation activities, are provided to the Committee. Specific Message updates about Rail applications and relevant contributions to the RTCM SC-134 Interoperability test are provided.

Press articles

The academic partners of the VICE4RAIL project will ensure the publication of at least 1 article per year in specialised magazines and scientific journals in terms of open access, namely: IEEE Access, IEEE transaction on ITS, IEEE Intelligent Transportation Systems Magazine, Scientific Reports – Nature Journal


Public deliverables


All public deliverables produced will be consolidated in public printable PDF files available on the project website.

STAFF EFFORT

Staff effort per participant							
Grant Preparation (Work packages - Effort screen) — Enter the info.							
Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
1 - RFI	14.00	8.00	6.00	12.00	13.00	8.00	61.00
2 - RDL	22.00	3.00	10.00	20.00	5.00	10.00	70.00
3 - ITCF		3.00			17.00	1.00	21.00
4 - BVI		3.00			15.00	1.00	19.00
5 - CEDEX			6.00	12.00		2.00	20.00
6 - UPCE		14.00	4.00		2.00	4.00	24.00
7 - UNI EIFFEL		2.00	7.00	7.00	2.00	2.00	20.00
8 - SGI		3.00	15.00	15.00	2.00	1.00	36.00
9 - SNCF		3.00	4.00		4.00	1.00	12.00
Total Person-Months	36.00	39.00	52.00	66.00	60.00	30.00	283.00

LIST OF DELIVERABLES

<div>Deliverables</div> <div><i>Grant Preparation (Deliverables screen) — Enter the info.</i></div> <div><i>The labels used mean:</i></div> <div><i>Public — fully open ( automatically posted online)</i></div> <div><i>Sensitive — limited under the conditions of the Grant Agreement</i></div> <div><i>EU classified —RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444</i></div>						
Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D1.1	D1.1 Project and Risk management Plan	WP1	1 - RFI	R — Document, report	SEN - Sensitive	4
D1.2	D1.2 Data Management Plan	WP1	1 - RFI	DMP — Data Management Plan	SEN - Sensitive	6
D2.1	D2.1 Rail user & system requirements	WP2	1 - RFI	R — Document, report	PU - Public	6
D2.2	D2.2 Risk Analysis Evaluation report	WP2	3 - ITCF	R — Document, report	PU - Public	10
D2.3	D2.3 Certification Plan	WP2	4 - BVI	R — Document, report	PU - Public	10
D2.4	D2.4 Synergies in the certification process for use in multimodal transport	WP2	6 - UPCE	R — Document, report	PU - Public	10
D3.1	D3.1 Overall Architecture Design Document	WP3	8 - SGI	R — Document, report	PU - Public	12
D3.2	D3.2 Detailed Design Document	WP3	2 - RDL	R — Document, report	SEN - Sensitive	19
D3.3	D3.3 System Requirement Document	WP3	8 - SGI	R — Document, report	PU - Public	10
D3.4	D3.4 Test Plan	WP3	2 - RDL	R — Document, report	PU - Public	19
D4.1	D4.1 Procurement List Documen	WP4	8 - SGI	R — Document, report	SEN - Sensitive	19
D4.2	D4.2 Developmen t Report	WP4	2 - RDL	R — Document, report	SEN - Sensitive	26
D4.3	D4.3 Test Report	WP4	2 - RDL	R — Document, report	PU - Public	29

<div>Deliverables</div> <div><i>Grant Preparation (Deliverables screen) — Enter the info.</i></div> <div><i>The labels used mean:</i></div> <div><i>Public — fully open ( automatically posted online)</i></div> <div><i>Sensitive — limited under the conditions of the Grant Agreement</i></div> <div><i>EU classified —RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444</i></div>						
Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D5.1	D5.1 Validation Strategies	WP5	1 - RFI	R — Document, report	SEN - Sensitive	35
D5.2	D5.2 Certification on Board subsystem	WP5	4 - BVI	R — Document, report	SEN - Sensitive	36
D5.3	D5.3 Certification on track subsystem and related system integration	WP5	3 - ITCF	R — Document, report	SEN - Sensitive	36
D6.1	D6.1 Dissemination on Exploitation and Communication plan	WP6	2 - RDL	R — Document, report	PU - Public	4
D6.2	D6.2 Dissemination, Exploitation and Communication Report	WP6	2 - RDL	R — Document, report	PU - Public	4

Deliverable D1.1 – D1.1 Project and Risk management Plan

Deliverable Number	D1.1	Lead Beneficiary	1 - RFI
Deliverable Name	D1.1 Project and Risk management Plan		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	4	Work Package No	WP1

Description
This report contains the project management plan along with the updated risk table

Deliverable D1.2 – D1.2 Data Management Plan

Deliverable Number	D1.2	Lead Beneficiary	1 - RFI
Deliverable Name	D1.2 Data Management Plan		
Type	DMP — Data Management Plan	Dissemination Level	SEN - Sensitive
Due Date (month)	6	Work Package No	WP1

Description
This report contains the data management plan

Deliverable D2.1 – D2.1 Rail user & system requirements

Deliverable Number	D2.1	Lead Beneficiary	1 - RFI
Deliverable Name	D2.1 Rail user & system requirements		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP2

Description
Rail user and system requirements for the virtualized testing and certification platform

Deliverable D2.2 – D2.2 Risk Analysis Evaluation report

Deliverable Number	D2.2	Lead Beneficiary	3 - ITCF
Deliverable Name	D2.2 Risk Analysis Evaluation report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	10	Work Package No	WP2

Description
This constitutes the effective fixation of the requirements and the road map to arrive to the certificate

Deliverable D2.3 – D2.3 Certification Plan

Deliverable Number	D2.3	Lead Beneficiary	4 - BVI
Deliverable Name	D2.3 Certification Plan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	10	Work Package No	WP2

Description
This constitutes the effective fixation of the requirements and the road map to arrive to the certificate

Deliverable D2.4 – D2.4 Synergies in the certification process for use in multimodal transport

Deliverable Number	D2.4	Lead Beneficiary	6 - UPCE
Deliverable Name	D2.4 Synergies in the certification process for use in multimodal transport		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	10	Work Package No	WP2

Description
Common elements of certification procedures resulting from the task T2.3 are described.

Deliverable D3.1 – D3.1 Overall Architecture Design Document

Deliverable Number	D3.1	Lead Beneficiary	8 - SGI
Deliverable Name	D3.1 Overall Architecture Design Document		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	12	Work Package No	WP3

Description
The overall Design Document is carried out. It contains the Model definition.

Deliverable D3.2 – D3.2 Detailed Design Document

Deliverable Number	D3.2	Lead Beneficiary	2 - RDL
Deliverable Name	D3.2 Detailed Design Document		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	19	Work Package No	WP3

Description
It contains the detailed Design and Interfaces of each Architectural block

Deliverable D3.3 – D3.3 System Requirement Document

Deliverable Number	D3.3	Lead Beneficiary	8 - SGI
Deliverable Name	D3.3 System Requirement Document		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	10	Work Package No	WP3

Description
It contains the whole System and Interface Requirements

Deliverable D3.4 – D3.4 Test Plan

Deliverable Number	D3.4	Lead Beneficiary	2 - RDL
Deliverable Name	D3.4 Test Plan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	19	Work Package No	WP3

Description
It contains the unit and integration Test Procedures and Plan

Deliverable D4.1 – D4.1 Procurement List Document

Deliverable Number	D4.1	Lead Beneficiary	8 - SGI
Deliverable Name	D4.1 Procurement List Document		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	19	Work Package No	WP4

Description
This report lists HW and SW purchased during procurement activities

Deliverable D4.2 – D4.2 Development Report

Deliverable Number	D4.2	Lead Beneficiary	2 - RDL
Deliverable Name	D4.2 Development Report		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	26	Work Package No	WP4

Description
It contains the development details for the activities of the tasks T4.2, T4.3

Deliverable D4.3 – D4.3 Test Report

Deliverable Number	D4.3	Lead Beneficiary	2 - RDL
Deliverable Name	D4.3 Test Report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	29	Work Package No	WP4

Description
This report shows the outcomes of the lab and field tests

Deliverable D5.1 – D5.1 Validation Strategies

Deliverable Number	D5.1	Lead Beneficiary	1 - RFI
Deliverable Name	D5.1 Validation Strategies		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	35	Work Package No	WP5

Description
Validation Strategy and example of validation reports at system level

Deliverable D5.2 – D5.2 Certification on Board subsystem

Deliverable Number	D5.2	Lead Beneficiary	4 - BVI
Deliverable Name	D5.2 Certification on Board subsystem		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	36	Work Package No	WP5

Description
This deliverable represents certification to evaluate the conformity of the essential requirements

Deliverable D5.3 – D5.3 Certification on track subsystem and related system integration

Deliverable Number	D5.3	Lead Beneficiary	3 - ITCF
Deliverable Name	D5.3 Certification on track subsystem and related system integration		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	36	Work Package No	WP5

Description
This deliverable represents certification to evaluate the conformity of the essential requirements

Deliverable D6.1 – D6.1 Dissemination Exploitation and Communication plan

Deliverable Number	D6.1	Lead Beneficiary	2 - RDL
Deliverable Name	D6.1 Dissemination Exploitation and Communication plan		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	4	Work Package No	WP6

Description
It contains the dissemination, exploitation and communication activities plan

Deliverable D6.2 – D6.2 Dissemination, Exploitation and Communication Report

Deliverable Number	D6.2	Lead Beneficiary	2 - RDL
Deliverable Name	D6.2 Dissemination, Exploitation and Communication Report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	4	Work Package No	WP6

Description
It summarises all communication, dissemination and exploitation activities and their impact.

LIST OF MILESTONES

Milestones					
Grant Preparation (Milestones screen) — Enter the info.					
Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
1	MS1 Kick-Off Meeting	WP1	1 - RFI	Minutes of the Meeting	1
2	MS2 System Requirements and Certification Plan Review	WP2	6 - UPCE	Review of Deliverables	10
3	MS3 Critical Design Review	WP3	8 - SGI	Architecture review, Review of Deliverables	20
4	MS4 Site Acceptance Test	WP4	2 - RDL	Successful completion of prototype development phase; On-site and laboratory tests execution activities with associated Test Reports	30
5	MS5 Certification process Review	WP5	4 - BVI	Review of Deliverables	34
6	MS6 Final Review	WP1, WP4, WP6, WP5	1 - RFI	Review of all available Deliverables	36

LIST OF CRITICAL RISKS

Critical risks & risk management strategy			
Grant Preparation (Critical Risks screen) — Enter the info.			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	Partner withdraws from the project	WP3, WP1, WP4, WP2, WP5, WP6	Follow the replacement partner approach set out in CA. Generate list of potential replacements and select a replacement in consultation with the Project Officer.

Critical risks & risk management strategy <i>Grant Preparation (Critical Risks screen) — Enter the info.</i>			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
2	Budget inappropriately assigned	WP3, WP1, WP4, WP2, WP5, WP6	Re-distribution of budget according to the importance of the project: renegotiating the value-for-money with WP leaders/partners to achieve a better balanced output against payment. These need prior approval by the EC.
3	Problems in respecting the planning and respecting deadline	WP1	Progress monitoring, improving communications within partners, increase of reminders, when necessary, early detection of critical situation, adoption of recovery plans.
4	Lack of quality of partner contributions and low quality of deliverables	WP3, WP1, WP4, WP2, WP5, WP6	Internal peer review of deliverables, draft version of all documents will be shared as early as possible (at least 1- month due date); regular communication with WP and task leaders.
5	Underestimation of the effort required to reach the goals	WP3, WP1, WP4, WP2, WP5, WP6	Continuous monitoring of effort spent, achieved results and detection of the deviation from the approved plan. EVM techniques will be adopted as a measurement tool.
6	Disagreement among partners about IPR	WP1	CA will be signed prior start, establishing IPR rules/management, and identifying expected results/owners.
7	Turnover of key personnel during project with Loss of key know-how and delays due to re-hiring	WP3, WP1, WP4, WP2, WP5, WP6	Each partner has the required resources for substituting key personnel and is responsible for adequate personnel turnover. To ensure effective information and documentation exchange, online collaboration tools – with Document Management features – will be used.
8	Consortium members not able to fulfil responsibilities according to project agreement with the impact on goals fulfilment	WP3, WP4, WP2, WP5	Continuous Project monitoring and reallocation to an alternative partner if required by the contingency plan, based on a partial overlapping of competences among partners involved in design and implementation.
9	Failure in risk management with the impact that goals may not be reached	WP3, WP1, WP4, WP2, WP5, WP6	Detailed risk analysis at the beginning of the project and adoption of Risk Management control tools and procedures.
10	Analysis or reviews fail with the impact on delay and on fulfilment of objectives	WP3, WP4, WP2, WP5	Development quality control scheme is adopted by the project coordinator. Partners already made similar work experience in relevant fields.
11	Lack of relevant tools, equipment and DUT provision for the HyVICE development, enhanced terminals, and supporting tools with the impact on timing (delay).	WP3, WP4	Partners have experience in developing their respective items and already own tools and equipment. The composition of the DUT and corresponding provider will be agreed to guarantee availability for the project.

Critical risks & risk management strategy <i>Grant Preparation (Critical Risks screen) — Enter the info.</i>			
Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
12	Network infrastructure and tools / equipment for testing not on site on time causing delay	WP3, WP4	Conservative Planning and available back up of tools/equipment. Project activities are reorganised.
13	Development requires significantly more resources than expected with the impact on delay and costs.	WP4	Involved partners have previous experience in developing HW/SW tools. A detailed baseline plan will be agreed, then it will be continuously updated.
14	Ineffective diffusion of project results to rail, and space communities with the impact of delay in standard definition and adoption	WP6	Well-defined dissemination plan, engagement of highly active partners in standardisation bodies
15	Inadequate Dissemination Implementation with the impact of Management Policy related on European Market visibility	WP6	Tight cooperation with the end-users. Participation in relevant events. Dissemination activities monitoring and eventual re-modulation.
16	Interfacing platform and tools from different partners	WP3, WP4, WP2, WP5	Setting up ongoing communication between interfacing parties to manage interfacing risks. Setting preliminary remote connections.

PROJECT REVIEWS

Project Reviews			
Grant Preparation (Reviews screen) — Enter the info.			
Review No	Timing (month)	Location	Comments
RV1	18		Mid-Term review (in presence with coordinator and WP leaders)
RV2	36		Final Review (in presence with coordinator and WP leaders)

HYBRID VIRTUALIZED TESTING FOR CERTIFICATION OF EGNSS IN RAILWAY TRAIN POSITIONING - VICE4RAIL

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1 Excellence #@REL-EVA-RE@#

The VICE4RAIL project stands at the forefront of advancing the certification of EGNSS for the ERTMS standard, ushering in a transformative era for rail safety and efficiency. In alignment with the EGNSS work program, our initiative addresses the critical need to integrate EGNSS technologies into train localization applications. Our overarching goal is to contribute to the establishment of an industry-accepted certification procedure that assesses the integration of GNSS-based train localization into the train control system with ERTMS. Unlike conventional approaches limited to virtual balise and enhanced odometry solutions, VICE4RAIL is designed to ensure scalability and flexibility in accommodating evolving train localization technologies. In collaboration with standardization groups and the Europe's Rail System Pillar, VICE4RAIL aspires to create a system capable of independently assessing the performance of different customized train position and velocity determination systems using EGNSS technologies. Excellency is also pursued through the realization of a dedicated testing line for assessing EGNSS performance in any possible operational scenario, connected with the accredited ERTMS laboratory to ensure the correctness and effectiveness of the EGNSS-based ERTMS certification process.

1.1 Objectives and ambition #@PRJ-OBJ-PO@#

Certification of train control systems compliant with the ERTMS standard, that adopts EGNSS technologies to localize a train, is critical, time consuming but indispensable to close the current gaps that prevent the adoption of EGNSS for the highly regulated rail safety critical applications. On the other hands, the results of many projects and studies undertaken in the last decade, funded by EUSPA, ESA, and Shift2Rail, have clearly demonstrated cross benefits arising from the utilisation of the EGNSS infrastructures and the improvement of the ERTMS efficiency, being both two pillars of the European industrial policy. Furthermore, the European Parliament in its resolution of July 2021 pointed out *the need to ensure synergies between the ERTMS and the EGNSS as soon as possible considering that exploitation of EGNSS services do not need equipment deployed along the railway, like the eurobalises, which are rather expensive to deploy, to maintain and potentially vulnerable*. Therefore, EGNSS-based train positioning is a strategic asset to speed up the ERTMS roll-out in Europe and to enhance its competitiveness outside Europe, especially where its competitor PTC system already adopts the GNSS technology. Two important and interlinked aspects will be taken into consideration: the identification of proper certification procedures to allow the use of EGNSS and the construction of a dedicated reference testing environment based on the *near zero-on-site testing* paradigm to support the validation and certification process. The approach is to install the whole DUT (Device Under Test) on board of a test train operating on a dedicated rail testing circuit provided by RFI. While the GNSS receiver will be fed by the RF signals produced by a GNSS RF signal generator, like in the zero on-site test approach, the IMU sensor package will experience real accelerations and angular velocities. The objective is to allow testing, in one single place, the behaviour of an ERTMS signalling system integrating any GNSS-based localization solution, under different scenarios and operational conditions as if the rail circuit were deployed anywhere in the World. The main challenge is to guarantee the consistency among real (accelerometer, gyro, and odometer) measurements and GNSS computer generated signals. This architecture is flexible and can evolve to perform tests, validations and certification of innovative products and services when new EGNSS features are introduced by EUSPA and new ERTMS specifications and functionalities are established by the rail community. In addition to the expertise collected by the partners of the project in this field, during many H2020 research projects, funded by EUSPA, the design of the certification procedure will benefit from the know how acquired by means of the Novara – Rho Pilot Line activities. This Pilot Line funded by RFI as a contribution to integrate GNSS positioning into the ERTMS system is in the final stage of validation and certification. Other than the GNSS, a communication system integrating satcom technologies - as also auspicated by EUSPA- are part of the Pilot Line to leaving the functioning of the ERTMS system unchanged while exploiting the advantage given by reductions in installation and maintenance costs, lower consumption, and increased efficiency. The Novara-Rho line represents the first step in Europe for identifying the boundaries to certify the ERTMS system with satellite technologies and its results will concur to the next step for a standard and interoperable solution.

1.1.1 Objectives

The main objectives of the project are:

OBJECTIVE 1: Develop a comprehensive certification methodology and procedure to evaluate the integration of GNSS and IMU technologies for train positioning into train control systems, ensuring compliance with the ERTMS/ETCS standard related to SIL-4 signalling systems and their future evolutions. This includes defining and executing a series of evaluations and validations to ensure the reliability, accuracy, and integrity of the train positioning systems within the context of ERTMS/ETCS.

OBJECTIVE 2: Design and establish a Hybrid Virtualized Testing Certification Environment (HyVICE) with associated facilities and tools. The HyVICE Environment should be capable of executing tests outlined in Objective 1, providing realistic and reliable representations of real-world effects in the context of ERTMS/ETCS.

OBJECTIVE 3: Create and maintain a repository of diverse scenarios and test patterns. These resources will be used to conduct the tests outlined in Objective 1, ensuring thorough evaluations of the train control systems' performance under various conditions.

OBJECTIVE 4: To deploy the full HyVICE at a dedicated rail test circuit setting up the necessary infrastructure to carry out the tests that integrates real and synthetic data to simulate a full range of operational scenarios.

OBJECTIVE 5: Reproduce at ERTMS lab the set of test scenarios previously run at rail test circuit and perform a validation of the lab test results based on the comparison against onsite tests.

OBJECTIVE 6: Develop a system capable of generating standardized test patterns and accompanying documentation to support the certification of localization and positioning systems. This system will encompass raw data, radio frequency samples, high-fidelity simulation data, IMU and Augmentation network data, catering to the diverse needs of manufacturers seeking product certification.

These objectives collectively aim to contribute to the advancement of GNSS and IMU technologies for train localization within the ERTMS framework, providing a robust testing environment for certification and performance evaluations. The project aims to leverage a standardized EGNSS-based Augmentation network with international scalability, utilizing GALILEO features to ensure independence and complementarity to GPS. The objective is to replace fixed balises with virtual balises in the ERTMS system. Additionally, the project seeks to contribute to a standardized and certifiable solution for generating high-quality Ground Truth and Digital maps, supporting precise train localization. A key focus is on assessing the utilization of a multi-modal augmentation network, aligning with Rail, Automotive, and Maritime common user needs to achieve an economy of scale. The certification process will emphasize GNSS continuity, often overlooked in rail and road transport, despite being the most demanding GNSS requirement in aviation. To facilitate this, a liaison will be established with the RTCM SC 134 Standardization Group, the Europe's Rail System Pillar, and the R2DATO project funded by Europe's Rail.

The overall system will be capable to assess the performance of different customised train position and velocity determination systems integrating the GNSS technologies and to verify the compliance to the ERTMS/ETCS standard of the whole system, with respect to accuracy and integrity requirements. The system will be able to operate independently of the specific technology used for the train localization by the signalling system provider.

1.1.2 Ambition

VICE4RAIL has the ambition to capitalize on the results of ten years of R&D projects to develop the remaining tasks to fill the GAPS that still prevents the use of EGNSS for the ERTMS. The motivation lies in the possibility of implementing the ERTMS localization function by using EGNSS technologies and the EGNOS infrastructure to enable on the one hand an efficient and faster deployment of ERTMS solutions as soon as possible for the ongoing ERTMS deployments and, from the other hand, to start using EGNOS by the railway's community who has the potential to become the main user. Furthermore, a forward-looking approach will be pursued looking to the evolving needs of the ERTMS and the new features promised by the planned EGNSS and EGNOS roadmaps. The ambition is also to inherit the results of the Pilot Line Novara – Rho project funded by RFI to integrate the ERTMS with GNSS positioning, and the GATE4Rail project funded by Shift2Rail which has mastered the virtualization paradigm to

realize a zero-on-field test laboratory to validate the GNSS into the ERTMS. A strong commitment is to create a suitable liaison with the Europe's Rail Flagship Project R2DATO to advance automation in railways and involve satellite stakeholders. A distinctive contribution of VICE4RAIL is the realization of a testing platform - crucial to validate and certify the GNSS-based ERTMS system. It consists of a dedicated railways circuit of RFI as a testing facility, connected with the CEDEX ERTMS accredited laboratory. This architecture – virtualized and scalable - will allow to independently assess the global ERTMS chain equipped with any GNSS based localisation unit and to generate the standard documentation for sustaining the certification process. Such infrastructure - similar to the one realized in the USA for the PTC - is designed to record, process and play datasets (GNSS and IMU) from the field and to emulate EGNSS signals with a high-fidelity representation of global and local effects, including the correction messages provided by Augmentation Networks. The vision is to create the foundations of a permanent service, with standardised toolsets and patterns, for the suppliers, ERTMS laboratories and Notified Bodies (NoBos) to assess, validate and certify the products. One of the “hard to remove” gaps in the certification process of EGNSS systems with high safety integrity levels, is a process to evaluate the impact of GNSS faults, especially those which are extremely rare and difficult and expensive to assess with only field tests. Our platform ensures that the safety of the system is thoroughly evaluated and verified by exploiting the Zero on Site Testing methodology peculiar to simulate/emulate faults caused by the GNSS, as successfully demonstrated by the GATE4Rail project and recognised by the *S2R JU to trigger actions for ensuring the exploitation of the research results into higher TRL*. Furthermore, when designing the certification methodology, we must consider the fact that we can expect that, to provide localization services even in harsh environments and in GNSS denied areas, multi-sensor localizers are needed by integrating GNSS with other localisation technologies, such as IMUs and in future video and Lidar opening to a Hybrid Virtualized Testing Certification Environment, specifically designed to evaluate the performance of future multisensory solutions.

In terms of maturity of the solution, the VICE4RAIL product will be at Technology Readiness Level (TRL) 7, not yet reached to our knowledge in Europe and in line with the objective to put in operation a GNSS-based ERTMS system by 2027. TRL 7 represents a stage where the technology is ready for system prototype demonstration in an operational environment.

##\$PRJ-OBJ-POS#

1.2 Methodology ##@CON-MET-CM@# ##@COM-PLC-CP@#

The methodology of the VICE4RAIL project unfolds as a meticulous and multi-faceted approach, designed to address the intricacies of testing, certification, and validation in the realm of advanced railway technologies. The narrative begins with the transition from the GATE4Rail setup, marking a crucial evolution in the testing environment. The innovative integration of real (IMU) and synthetic (GNSS) sensor data, coupled with real-time closed-loop operations, forms the foundation for dynamic testing scenarios of the HyVICE.

The HyVICE functional blocks are shown in the following Figure 1.

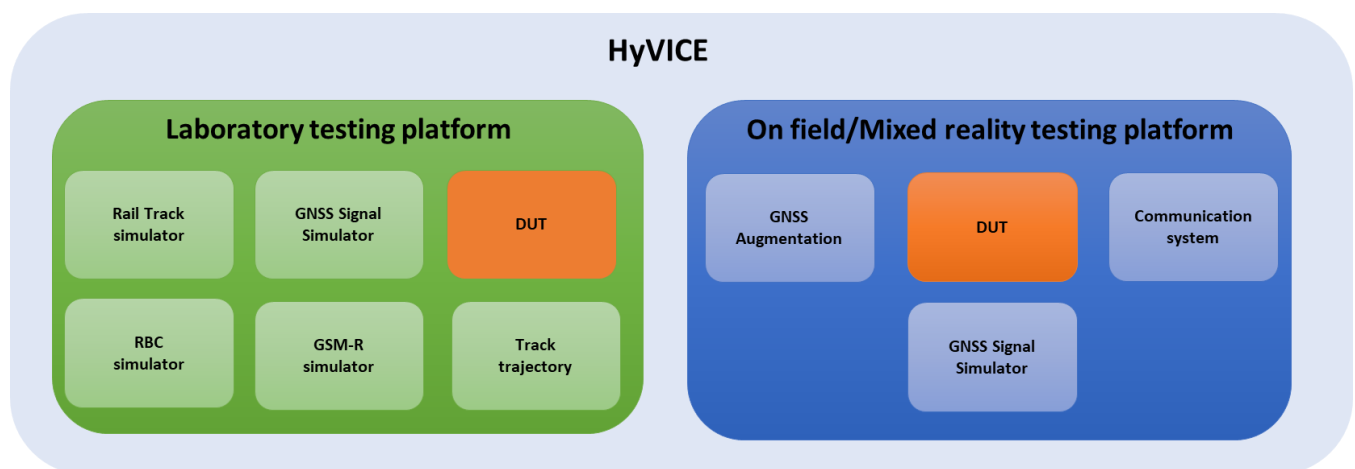


Figure 1: Functional Blocks HyVICE

1.2.1 Overall Methodology concept

The core challenge lies in real-time modelling of the electromagnetic environment, emphasizing the nuanced multipath effects. Here, the project aims to break new ground by accurately quantifying and modelling these effects using state-of-the-art error models and tools. Real experiments on the Bologna San Donato Test Circuit will provide a tangible and dynamic backdrop, where the actual position of the train becomes a product of applied controls, creating a real-world testing ground for GNSS and IMU technologies. In parallel, the project delves into the intricacies of GNSS performance, distinguishing between global and local errors. Global errors, influenced by atmospheric and system causes, are addressed through existing models. Local effects, shaped by the immediate electromagnetic surroundings of the receiver antenna, pose a unique challenge. The project explores advanced modelling techniques, for accurate representation. A deep analysis of the reliability and representativity of 3D models and raytracing for a railway application is on the horizon, promising to provide insights into the viability of these approaches.

The testing environment will be used by manufacturers and system integrators for performance evaluation, optimization, and preliminary verification of compliance with the standard and by Notified Bodies for certification. The testing environment will also include the generation of Augmentation and Integrity Monitoring data as if they were provided by SBAS (e.g., EGNOS V2 and/or future version if available during the execution of the present project) as well as by local augmentation networks, including 2-tier architectures as those proposed in the H2020 HELMET project, funded by EUSPA, focusing on DGNSS and RTK. The proposed testing methodology for the San Donato circuit involves a comprehensive approach utilizing Model-in-the-Loop (MIL), Hardware-in-the-Loop (HIL), and Software-in-the-Loop (SIL) techniques. MIL is employed for signal synthesis at the antenna level, while HIL focuses on testing the real system within a virtualized electromagnetic environment, ensuring equivalence to a physical circuit anywhere on Earth. This approach is particularly crucial for addressing the challenges associated with testing Inertial Measurement Units (IMUs) through virtualized accelerations, especially in systems with multiple positioning sources. The integration of MIL, HIL, and SIL enables a thorough examination of the entire system, aligning with subset 76 for European Train Control System (ETCS) standards. By incorporating these testing methodologies, we aim to establish a robust test bench solution that encompasses the entire spectrum of testing requirements, from individual components to the complete system. This professional and integrated approach ensures the reliability and performance of the San Donato circuit in compliance with ETCS subset 76.

The VICE4RAIL methodology extends its reach beyond railways, drawing inspiration from the automotive and maritime sectors. Synergy with self-driving car technology opens avenues for virtual testing and certification of safety functions for GNSS-based train location. Insights from automotive safety standards and practices are meticulously examined, acknowledging the differences in safety concepts, principles, and standards between road and rail. The overarching aim is not just the advancement of railway technologies, but the establishment of a robust, adaptable, and harmonized framework that ensures the seamless integration of cutting-edge solutions into commercial railway lines. The journey, marked by field experimentation, interdisciplinary collaboration, and technological exploration, positions VICE4RAIL at the forefront of shaping the future of railway systems.

1.2.2 Scenarios for realistic simulations

In the realm of future on-board localization units, the pivotal role of GNSS is acknowledged, yet challenges persist in accurately modelling its performance, especially in the face of complex electromagnetic environments. The project, VICE4RAIL, seeks to overcome this challenge by employing advanced error models and tools.

Despite extensive discussions on multipaths, non-line-of-sight signals, and masking effects in current literature, accurately quantifying and modelling these phenomena remains a significant obstacle. Certification demands a thorough verification that the chosen models faithfully represent real-world conditions in a dependable and representative manner. Considering the diverse environments a train might encounter during its journey from station A to B, ranging from urban to rural settings with potential obstacles like bridges and tunnels, VICE4RAIL adopts a comprehensive approach. For this purpose, VICE4RAIL will rely on state-of-the-art error models and different tools: real experimentations on a test circuit and error models for which statistical error models and deterministic simulation techniques such as raytracing will be investigated.

1.2.2.1 On field/Mixed Reality Testing Platform - Bologna San Donato Testing Circuit

In the context of the VICE4RAIL project, the integration of the Bologna San Donato test circuit signifies a fundamental milestone in the execution of field tests. At its core, the process involves the meticulous creation and validation of virtual models for the GNSS electromagnetic environment. Furthermore, it encompasses collaborative testing of GNSS and IMU technologies, exposing the GNSS to a blend of real and synthetic data while the IMUs navigate authentic real-world scenarios.

In 2017, RFI made a strategic decision to repurpose the former freight yard beginning a transformative initiative, which involved the construction of a new curve to create a closed railway circuit spanning around 6 km. This strategic move positions the Bologna S.Donato Test Circuit as a pioneering hub in the European railway landscape. The circuit plays a crucial role in the certification process for rolling stock and ground components before their deployment on commercial lines. Covering an expansive area of 1.25 km² and featuring a single-track length of 5749 m.



Figure 2: Bologna San Donato Test Circuit

The circuit provides market services that enable applicants to develop and test new infrastructure systems/components to enhance performance, reliability, and maintainability. It also allows 24/7 test runs without disrupting regular traffic, facilitating regulatory releases, certifications, and approvals to streamline the commissioning phase of new rolling stock. Highlighting the technical features of the San Donato Test Circuit:

- kV DC electrification system.
- Maximum elevation: 160 mm.
- Maximum achievable speed for rolling stock: 120 km/h.
- Railway track constructed with high-speed UNI 60 rails and RFI 260 sleepers.
- Current signalling system consists of 4 block sections, each 1350 m long, with BACC managed by ACCM.
- Regarding signalling tests, the line loop is equipped with Eurobalise SCMT, TAG SSC, and, starting from 2024, an ERTMS – L2 system with RBC, enabling the testing of new rolling stock during homologation.

Within the ambit of activities conducted at the facility, three overarching areas come to the forefront. The first comprises homologation and certification, involving the setup of new rolling stock models, pre-service commissioning tests on commercial lines, and post-upgrade testing of the railway system. The second area centres around the development of interoperability systems, including integration tests between ground and onboard systems (such as HD ERMTS), electromagnetic compatibility tests between electric traction trains and ground signalling systems and calibration tests of measurement systems installed on diagnostic trains. Finally, and no less crucial, the third area encapsulates all activities associated with RFI's research and development department. The Circuit serves as an expansive and dynamic open-air laboratory, fostering collaborative research projects with universities and scientific research institutions. This includes the development of advanced diagnostic systems for tracks, power lines, and railway switches and the internal development of new technologies for enhancing the overall resilience and efficiency of railway infrastructure.

VICE4RAIL field testing in Bologna aims to:

- Create and validate virtual models for the GNSS electromagnetic environment.
- Jointly test and certify GNSS + IMUs, through procedures for which GNSS receiver can receive either real or synthetic data, or a blend of them, while IMUs experience real train dynamics.
- Add interferences (jamming and spoofing) to real GNSS signals, to test vulnerability/resilience of both signal and data processing stages.

In Figure 3 the functional architecture of the On field/Mixed reality testing platform that will be developed in VICE4RAIL and deployed in the RFI Bologna San Donato Testing Circuit is presented.

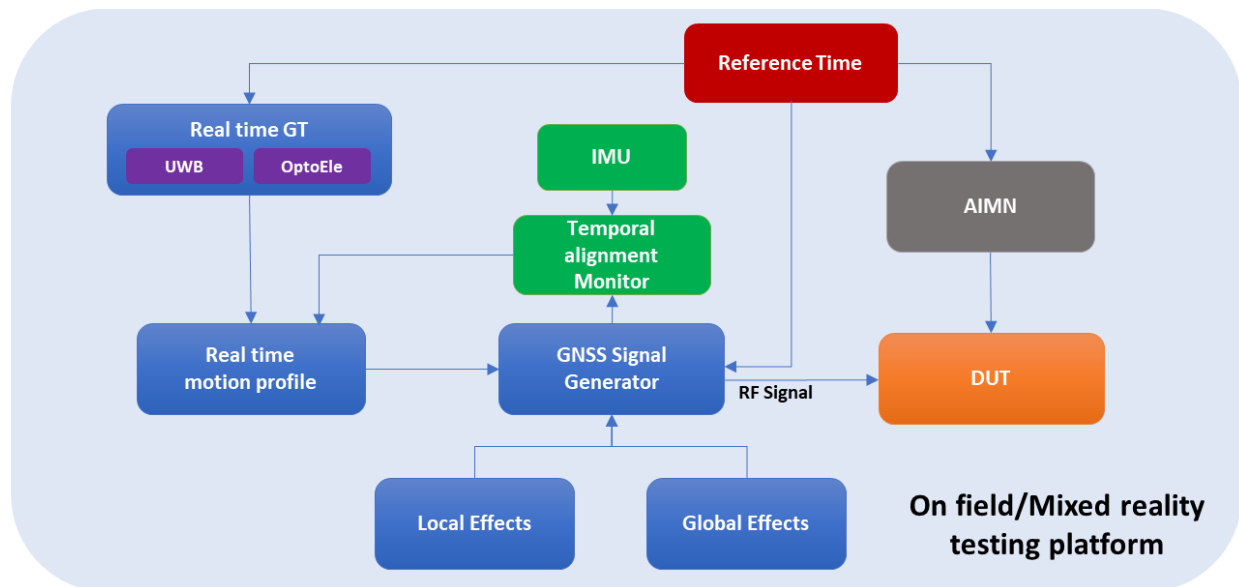


Figure 3: On field/Mixed reality testing platform functional blocks

To guarantee the coherence between accelerations and angular rates sensed by the IMU package of the DUT and the SISs injected into the GNSS receiver chain, a real time GT (Ground Truth) will be realized by using terrestrial ultra-wideband radio transmitters integrated with optoelectronics devices. To assure synchronization among all components, the platform will be equipped with a Reference Time distribution subsystem based on an atomic clock providing high short-term temporal coherence complemented with a GNSS receiver, for longer, stable, temporal coherence. Latencies and delays between the Real Time GT and the GNSS Signal Generator output will be continuously monitored by the Temporal Alignment Monitor. At this aim a high (e.g. tactical) grade IMU accurately sensing the train dynamics will be employed. The measured latencies and delays will then be compensated through a short time train motion prediction performed by the real Time motion profile block. This block will provide real-time train dynamics profile including position, velocity, acceleration and timing to the GNSS Signal Generator block, that exploit the knowledge of the georeferenced circuit geometry. The GNSS Signal Generator will be responsible for the generation of synthetic GNSS signals both in nominal and faulty conditions by accounting for both global and/or local hazards (multipath, GNSS signal blockage, unintentional and intentional interferences). These faults will be made available to the GNSS RF signal generator by the Local and Global effects blocks and will be injected to test vulnerability/resilience of both signal and data processing stages. Therefore, as part of the VICE4RAIL project, the integration of the Bologna San Donato test circuit not only facilitates cutting-edge experimentation but also positions the circuit as a vital contributor to the broader research and development efforts in the railway industry. Its expansive infrastructure and technical capabilities make it an instrumental resource for certifying and advancing rolling stock and ground components, paving the way for their seamless integration into commercial railway lines.

1.2.2.2 Laboratory Testing Platform - CEDEX ERTMS SIMULATION LAB

CEDEX ETCS/ERTMS laboratory is an accredited lab for functional verification testing ERTMS components, such as EVCs (Euro Vital Computers) and Eurobalises and collects a deep experience on testing ETCS trackside implementations and onboard integration into the line at operational level. CEDEX lab has an important role testing Spanish real lines before authorization to put into service, allowing a significant reduction of on-site testing time and resources, as the real lines can be debugged in advance in the laboratory environment. Real ETCS trackside equipment (RBC) configured with corresponding project data associated to the line is connected to the lab, allowing testing it by using ETCS on-board equipment of different suppliers. The lab is, thus, composed by two test benches connected to main additional modules, as Track Simulation Tool (TST) and the GSM-R network simulator. Cedex current lab architecture is shown in Figure 4:

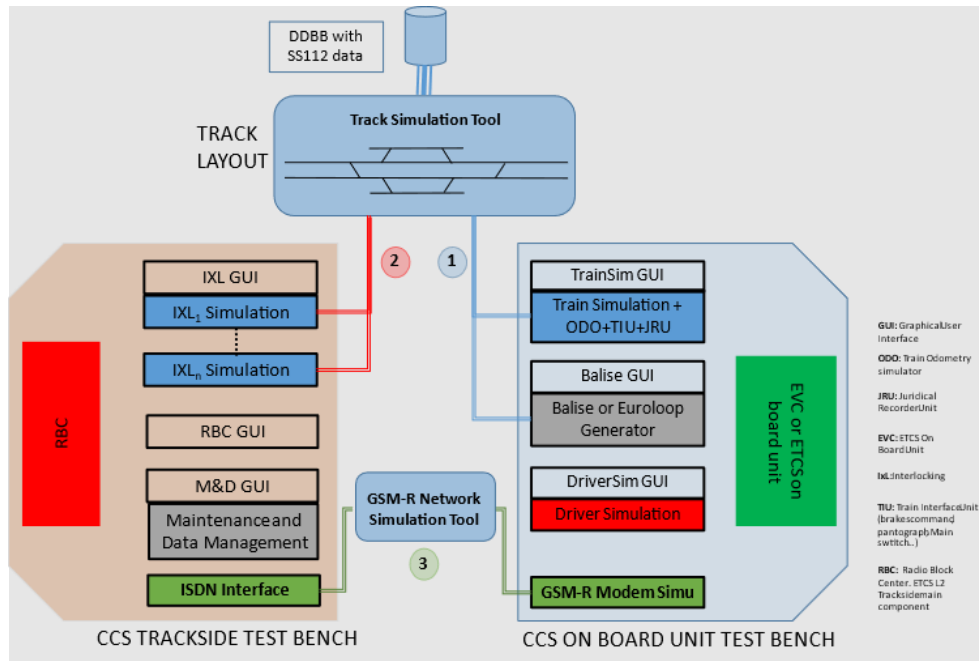


Figure 4: CEDEX ERTMS test lab current architecture

The main functions of each block are the following:

OBU test Bench where a real (or simulated) ETCS OBU is connected to be tested. It simulates the train movement, the interfaces between the OBU and the simulated train. It also generates the balise telegrams and connect the EVC to the GSM-R network simulator. **A Trackside test Bench** where a real (or simulated) RBC is connected to be tested. It can simulate the interlocking (IXL) or, alternately, in case of using a real IXL, this one relates to the local operation post to set the routes. The IXL is connected to the Track Simulation Tool (interface 2) to reproduce track circuits occupation, switches status and signals aspects. It also connects the RBC radio channel to the GSM-R network simulator to send/receive radio messages to/from the ETCS onboard.

GSM-R Network Simulator: This module simulates the GSM-R network and is the way of exchanging L2 messages between the RBC and the EVC. **Track Simulation Tool** simulates the real trackside. It is customized with the real track layout as well as all involved infrastructure and signalling elements. This tool provides the lab the functionality of moving the trains over the real track. The interface with the trackside (2) test bench is mainly the status of track circuits, switches, and signals aspects. The interface with the On-Board unit test bench (1) is bidirectional, exchanging balise telegrams and locations, and the train speed to allow the train moving over the simulated track. The simulation has the possibility of adding more trains to simulate several trains running over the line.

Figure 5 shows the proposed testing architecture for the project in case of testing ETCS Onboard Units with Enhanced Odometry that uses GNSS and IMU sensors. In this case three new blocks are integrated: one defining the ground truth and the environmental info of the specific line simulated in the Track Simulation Tool. The second one acts as a Satellite Signal Simulator that, based on this information will generate the GNSS signals to be injected into the real EVC that incorporates a GNSS receiver. The last block oversees reproducing the IMU signals generated during real trip.

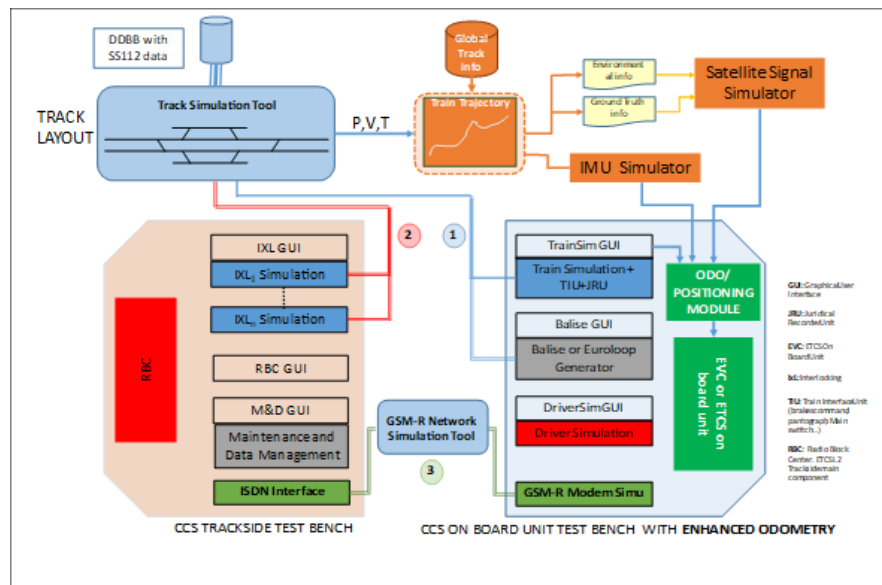


Figure 5: CEDEX ERTMS lab proposed Testing Architecture including GNSS+ IMU simulators

1.2.2.3 GNSS error modelling and simulation

This section undertakes a meticulous examination of GNSS error modelling and simulation within the context of the VICE4RAIL project. GNSS performances are impacted by global and local errors. Global errors are shared among users on large areas and are mainly caused by atmospheric propagation effects or systems causes (e.g., clock and ephemerid errors). Most of these global errors are today modelled in all GNSS signal simulators. Local effects are caused by close surroundings of the receiver antenna (e.g., electric traction portals, buildings, trees, overpasses, ...). Among them we cite multipath and shadowing. By essence, the large variety of situations that a train can experience make them difficult to model with a general-purpose model with few parameters. In the GATE4RAIL project, an approach based on first order probability distributions for these errors has been proposed. Recently, use of Artificial Intelligence (AI) algorithms has been proposed to model multipath error or to detect the type of Electromagnetic context in which the GNSS receiver operates. These techniques require extensive databases for good representativity of the phenomena. Their use is investigated in R2DATO (WP34/35). In VICE4RAIL, these studies will be extended considering the use of 3D models and ray-tracing tools for deterministic knowledge of signal propagation in a dedicated environment. Most of the existing literature concentrates on the characterization of GNSS local effects in urban environments, defined by urban canyon and geometrical buildings, where a concentration of users may be concerned with the position given by smartphones. The solutions can rely on geometrical knowledge of the environment with the use of 3D models or characteristics of the streets (width, length, height of buildings). Some propose ray-tracing strategies where every ray coming from satellites and received by antenna are modelled following geometrical optic laws. Some are mapping delays or multipath errors. In the context of the VICE4RAIL project, we will address the use of such techniques in the context of rail and certification, and we propose a deep analysis of the reliability and representativity of a model based on a 3D representation of the environment and raytracing for a railway application. The following issues will be investigated: State of the art of the use of Raytracing for GNSS local error modelling in rail to identify available models or their requirements as well as an overview of possibilities to generate such realistic models. Next important step will be to evaluate relevance and representativity of 3D-ray tracing multipath models along a railway line (to be tested with a simple or complex 3D model depending on their availability).

1.2.2.4 Conformity Assessment and Technical Documentation Procedures for Railway Subsystems

This section elucidates the comprehensive framework governing the conformity assessment and technical documentation procedures applied to railway subsystems within the VICE4RAIL project. The meticulous processes involve stringent verification and assessment stages, ensuring compliance with applicable Technical Specifications for Interoperability (TSIs) and European harmonized standards. From design assessment to assembly and operational evaluation, this section outlines the structured steps undertaken by the Notified Body (NoBo) and the Assessment Body (As.Bo). Emphasis is placed on the meticulous examination of technical documentation, risk management, and the pivotal role of conformity certificates in adhering to regulatory requirements.

The conformity assessment (EC approach) is generally based on “Unit Verification” (Module SG) / “Type examination” + “EC verification based on quality management system of the production process” (Module SB + Module SD) to ensure that the subsystem satisfies the requirements of the applicable TSI(s) including the European mandatory standards for the following stages (as defined in the module). The technical documentation of the Applicant shall indeed specify the requirements and cover, as far as relevant for the assessment, the design, manufacture, installation/construction, and operation of the subsystem. The NoBo. will assess the documentation provided by the Applicant according to the following essential requirements described for the applicable TSIs: safety; reliability and availability; health; environmental protection; technical compatibility; accessibility. The NoBo examines the technical documentation, based on the requirements matrix prepared by the applicant. If non-conformities are found, the NoBo will issue a detailed list of technical notes. When all non-conformities are closed, subsequently a revision of the documentation, the NoBo will officially inform the Applicant for closing any technical note. The results of this assessment phase form the technical basis for the compilation of the technical NoBo File. The Technical File must contain at least the information required by Article 18(3) of the Directive, namely: all necessary documents relating to the characteristics of the subsystem, the list of interoperability constituents incorporated into the subsystem, evidence of conformity with other legislation derived from the traceability matrix (including certificates), all elements relating to the maintenance, the conditions and limits for use of the subsystem and all elements relating to the instructions for service, continuous or periodic monitoring, adjustment and maintenance.

The procedure includes appropriate examinations and tests, as set out in the relevant TSI(s), harmonised standards and/or technical specifications, or equivalent tests, to check the conformity of the subsystem with the requirements of the relevant TSI(s). Based on the technical documentation supplied by the applicant and on the requirements matrix (impact analysis of the requirements), the NoBo shall agree with the applicant which tests and where the tests will be carried out and whether the final subsystem tests and, whenever required in the TSI, tests under full operating conditions, must be carried out by the applicant under the attendance of the notified body (witnessing activities). The NoBo shall assess the adequacy of the arrangements and decide on the level of witnessing required. In all cases, the NoBo retains the responsibility to the compliance of the results of the examinations, tests and checks. In instances where the subsystem meets the requirements of the TSI, the NoBo shall proceed, based on the design examination and the approval and surveillance of the quality management system, to generate the certificate of conformity to be submitted by the Applicant to the supervisory Authority in the Member State where the subsystem is located and/or operates. In addition, evaluation of the risk management process, as provided by the applicant, in alignment with Reg. 402/2013/EU as amended by 1136/2015/EU relating the changing on Common Safety Methods (CSM), will be carried out by the As.Bo in any case of a changes in the railway system. The discriminating factor on Assessment activities is based on considering the impact of this rail section: Relevant or Not Relevant change. Herein, the As.Bo review will include: Documentation of the proponent's risk analysis, developed in accordance with the CSM regulation, for the use of your subsystem in the railway system, analysis of the risk assessment document, a joint meeting on the risk analysis assessment and preparation of assessment reports.

The activities that will be carried out during the assessment process for each project phase, are detailed below:

Design Assessment:

- Checking of completeness, relevance and compliance to applicable legislation (TSI, European Harmonized standard, additional requirements defined in this project) to verify the list of specifications and technical standards that the applicant intends to use for demonstrating the compliance of the subsystem with the relevant TSI(s).
- Examination of design methods, tools, and design results to assess compliance with the relevant TSI(s).
- Checking of the correctness of values/parameters against applicable TSI requirements related to the final design.
- Checking if the interoperability constituents used are appropriate to the railway system and application.
- Issuance of conformity report for design stage.

Assembled, before putting into service:

- Checking that subsystems comply with the relevant design parameters set out in the relevant TSI.
- Examination of construction methods, review test documentation and perform site inspection to assess compliance with the requirements of the relevant TSI(s) as appropriate to the verification modules selected.
- If necessary, request appropriate examinations and tests, which haven't been carried out by Client, to ensure that the relevant harmonized standards and/or TSI's have been applied correctly.

If necessary, Assess the test reports to verify that checks and tests have been performed according to the relevant TSI(s) procedures.

1.2.2.5 Overview to fill the current gaps to enable a final certification

The gaps to certify the GNSS positioning in the frame of the ERTMS are related to the conformity of this new technology with the CENELEC norms, meaning that a standard process and tools must be developed and agreed. The process indicated in paragraph 1.2.2.4, specifically with the contribution of RFI's Novara Rho Project, represents a fundamental facilitator for closing the gaps and for introducing the GNSS technology into the new CCS TSI. In fact, the Novara-Rho line Project is the first to implement a formal process for the validation and certification of a GNSS-based ERTMS solution with all the "actors" involved. All the main constituents of this architecture are implemented: a) the on-board board unit capable to detect both the traditional fixed balise and the virtual balises using the GNSS positioning, b) the Radio Block Center with the interface to the Augmentation data and c) a Local Augmentation network. The certification process in the Novara-Rho is the starting point towards the search of a standardizable interoperable and evolutive certification process applicable to generic architectures in synergy with the R2DATO project. A further contribution to close the gaps is the definition of the interface with the future EGNOS services to use them in GNSS receivers for the rail domain, in the framework of the standard to be released by the RTCM SC 134 Special Committee devoted to High Accuracy High Integrity applications to which VICE4RAIL team members are contributing.

1.2.3 Connecting Project Synergies: Overview of National - International Research and Innovation Contributions

In the intricate web of research and innovation, VICE4RAIL strategically positions itself at the crossroads of national and international collaborations, with the liaisons to the national Pilot Line Novara-Rho and the Europe Rail R2DATO projects to forging synergies that amplify the project's impact. This section delves into the rich tapestry of contributions, both at home and on the global stage. The project draws extensively from the collective expertise cultivated in various national research initiatives. By leveraging insights from ongoing projects funded by entities such as EUSPA, ESA, and Shift2Rail. The collaborative spirit inherent in these initiatives not only propels the project forward but also ensures that the outcomes align with broader industry objectives.

The starting point are the results of past and on-going projects which have demonstrated the technical and economic viability of using virtual balises in the context of the ERTMS namely, ERSAT EAV, HELMET funded by EUSPA,

GATE4Rail funded by Shift2Rail, complemented by the results of the Pilot Line Novara Rho commissioned by RFI for the assessment and certification plan to allow the integration of the GNSS technology in the ERTMS L2 system. Indeed, RFI has achieved significant results within the ERSAT Program, having successfully tested the integration of GNSS technology in railways, by leveraging the "virtualization" of balises, in several projects and on the track in Sardinia on the "Cagliari-S. Gavino" line. More recently, activities to support the validation and certification phase of the "virtual balise" functionality were commissioned by RFI on the Pilot Line "Novara-Rho", where ERTMS L2 is already activated and in operation. The aim of the assessment activities was to:

- Assess that the specific solution (Reference Stations and Virtual Balise Reader) meets the safety requirements identified during the risk analysis (SIL4).
- Ensure the additional GNSS-based solution functions do not lead to conflicts with implemented functions specified in CCS-TSI. The on-board and RBC Generic Application have been assessed according to the SIL4 level defined in the CENELEC standards.
- At functional level, verify the non-intrusiveness of the additional satellite-related hardware with respect to signalling equipment already in service on the "Novara-Rho" Pilot Line.

The project includes the certification phase that improves the credibility of the project. The NoBo(s) have been involved in similar projects to evaluate the application of Balise as: 1) ERSAT-EAV – "virtual" balises managed by the satellite receiver, integrated into the ERTMS signalling system, 2) Novara-Rho railway line – experimental ERTMS L2 variant with satellite positioning, 3) Rail certification roadmap definition for the Contract No GSA/OP/07/13 – Provision of technical assistance in the GNSS market technology monitoring, stakeholders' marketing and economic modelling and forecasting.

Internationally, the project aligns itself with the global pulse of innovation. Collaborations with standardization Organizations, such as the RTCM SC 134 Standardization Committee, and engagements with the Europe's Rail System Pillar and innovation pillar signify a commitment to harmonizing efforts on a broader scale. In the context of the innovation pillar, VICE4RAIL will be set up to foster synergies with the R2DATO project. First, considering as input the strategy and general requirements for a common virtual certification process, proposed by the "Testing, validation and certification" work packages, and providing additional test benches to consolidate them. Moreover, the operational requirements, system capabilities and system architecture for Absolute Safe Train Positioning systems defined in the R2DATO project will be relevant to properly identify the potential systems under test and test environments in VICE4RAIL. Specifically, engagement with R2DATO WP34/35 dedicated to "testing, validation, and certification" and the recently launched WG focusing on EGNOS for Rail with its WP21 and WP3.5 related to certification and testing of GNSS with EGNOS for ERTMS SoL application is anticipated. In addition, a specific liaison with the results of the GATE4Rail project will be pursued since it provided a laboratory test architecture capable of simulating railway scenarios for GNSS-based ERTMS applications that allows to perform a zero on site testing including both the whole ETCS and the GNSS with global and local hazards. Both simulations of GNSS and ERTMS were integrated in such a way that the full impact on train control system was assessed.

As a project with ambitious goals, VICE4RAIL recognizes the need for a cohesive blend of expertise and methodologies. The interdisciplinary nature of the project demands a seamless integration of diverse knowledge domains and research methodologies. Within the project consortium, interdisciplinary integration manifests through the fusion of expertise from partners specialized in GNSS technologies, train control systems, and certification procedures. The collaborative efforts of engineers, researchers, and industry experts create a dynamic environment where diverse perspectives converge to address the multifaceted challenges posed by the integration of GNSS into the ERTMS standard. In essence, VICE4RAIL thrives at the nexus of national and international collaborations, drawing strength from a diverse pool of expertise. The interdisciplinary integration within the project serves as a testament to its commitment to holistic innovation, fostering an environment where the sum of collaborative efforts exceeds the individual contributions of its parts.

1.2.3.1 Synergy effects and technology transfer in multimodal transport applications

Self-driving car (SDC) technology is rapidly evolving to improve road safety. In this context, the automotive industry has made significant advances in the development of safety standards, Verification and Validation (V&V) methods

and certification procedures for automated driving including GNSS-based vehicle positioning. Much effort has been devoted to virtual testing of self-driving functions using various simulators to increase the safety and reduce development time and costs. Similar rapid progress is being made in the field of autonomous vessels.

The operating environment on the road is often even more complex than on the railway. It is natural to take inspiration from the automotive sector and consider the possible use of car location technologies and related safety demonstration procedures based on virtual testing for ERTMS. V&V procedures for certification must be viewed from multiple perspectives. When analysing the applicability of automotive safety technologies on railways, it is necessary to consider the differences between safety concepts, safety principles used, standards, safety demonstration procedures, etc. Similarly, as the railway EN 50126 (RAMS) is the umbrella for other railway safety standards (EN 50128, EN 50129, etc.), the automotive ISO/TR 4804 addressing the dependability (also covering safety) of automated driving, is the umbrella for other automotive ones - i.e. ISO 26262 (automotive functional safety), ISO/PAS 21448 (SOTIF - safety of the intended functionality) and ISO/SAE 21434 (cybersecurity). Automotive safety standards for SDC can thus be a great source of inspiration for virtual validation and certification of GNSS-based train positioning.

In the maritime sector, derivation of the minimum user requirements for GNSS set by the IMO (International Maritime Organisation) will be analysed and the underlying rationale for setting them will be identified. Regulatory system and equipment directives such as IMO SOLAS (Safety of Life at Sea) or Maritime Equipment Directive 2014/90/EU (repealing 96/98/EC), and relevant safety standards, such as ISO 17894 (Ships and marine technology - General principles for the development and use of PES in marine application) will be used. In developing the certification process, attention will be paid to continuity. In recent GNSS R&D projects, railway stakeholders have not yet clearly specified how to properly exploit the guaranteed continuity of GNSS. In contrast, the automotive ISO/TR 4804 states that continuity is not a key parameter of GNSS-based positioning with integrity. Yet the aeronautical requirement for continuity significantly determines the cost of GNSS infrastructure. It is desirable that the issue of exploiting GNSS continuity in multimodal transport be solved within this project.

1.2.4 Decision-making processes

In VICE4RAIL, technical decisions will be taken by the Technical Management Team (TMT) composed by the work package leaders and chaired by the coordinator. The TMT will ensure the cohesion between the WPs and check the execution of individual work packages in terms of their technical and programmatic contents and according to common engineering consistency. Strategic decisions will be taken by the Steering Committee (SC), composed of one institutional representative appointed by each of the participants. The SC is the formal decision-making body of VICE4RAIL. To examine all results in-depth at regular meetings with the members of the consortium an Advisory Board will be created. This board will provide technical, ethical and legal guidance, input, and feedback on the requested objectives and technology needs. VICE4RAIL working team brings together experienced scientists and technologists covering the entire value chain, from design to infrastructure management, and involves a wide range of knowledge and skills in different sectors: ERTMS, railway, EGNSS and certification domains. Of paramount importance for the efficient progress of the project is the sharing of a common background among the members of this multidisciplinary team and a clear understanding of the project objectives, methodologies, techniques and results. At this aim, plenary meetings will be periodically held. They will include seminars covering the different aspects of the project. Talk will be given by project key persons with specific skills and experience on the seminar topic. On the other hand, the core of the team is constituted by persons that have already teamed in several H2020 projects (e.g., RAILGAP, ERSAT GGC, HELMET, RHINOS) and have therefore already established a common background and very good interpersonal relationships.

1.2.5 Gender balanced representation

The VICE4RAIL project participants employ several female researchers, engineers, and scientists within their respective teams. The project covers a field, within the railway, where gender equality promotion is required because of the underrepresentation of women in technical disciplines in general and in industries such as mechanics, electronics development, and control. Therefore, VICE4RAIL will support the promotion of gender equality not only in the project but also in science and engineering. Concerning the project organization, the VICE4RAIL consortium is aware of the relatively low numbers of women in Science, Technology, Engineering and Mathematics (STEM) and will promote and encourage where possible the active participation of women representing its members in the

scientific work as well as in decision making groups. Attention will also be paid to other factors, such as age, abilities, ethnicity, and socioeconomic status. VICE4RAIL will prevent discrimination - including discrimination based on age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, sexual orientation - in all its activities. In this project, the Project Manager and the Administrative and Financial Manager are indeed women. The project has been conceived so that its goals are gender neutral.

1.2.6 Open Science

Open science practices will be adopted according to Figure 6, to share information on methodologies and results using open-source solutions based on the EU's open science policy. Concerning the digital research data generated in VICE4RAIL project, the partners will deposit in a research data archive such as Open Research Europe, Zenodo and Orcid, the research results and publications that will become accessible to all, aligned to FAIR (findable, accessible, interoperable data and reusability of data) principles. Measures will be taken to enable third parties to freely access, re-use, analyse, exploit, and disseminate the data. A Data Management Plan (DMP) will be produced in month T0+6 of the project by WP1 (D1.2) and will describe how research data processed or generated by VICE4RAIL will be made searchable, accessible, interoperable, and reusable.

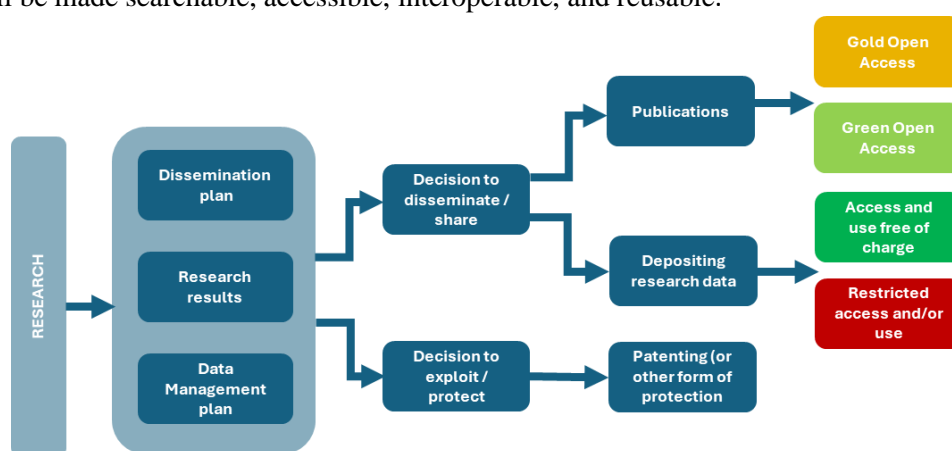


Figure 6: Publication strategy in Open Access

1.2.7 Data management and management of other research outputs

The VICE4RAIL Project Management will establish and regularly update a Data Management Plan. Data and other research output of the VICE4RAIL project will be stored in a trusted repository supporting a cooperative tool (i.e., EMDESK) in compliance with FAIR principles. The cooperation tool will allow team members to deposit their results in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce, and disseminate. The collaboration tool enables team members to submit their findings to a research data repository and implement measures to facilitate third-party access, analysis, utilization, reproduction, and distribution. Technical reports, internal documents, white papers, multimedia content (such as webinars and workshop videos), and dissemination materials will be accessible to users and stakeholders. Data required to validate results in scientific publications will be promptly provided, along with other specified data and associated metadata, adhering to the deadlines outlined in the Data Management Plan (DMP). The cooperative tool will also be used for project management and technical work, as well as for the organization of project meetings and deliverable tracking. In addition to the Consortium members, the data, and the other research output of the VICE4RAIL project will be shared with and made accessible to those stakeholders/end users also involved in the Steering Committee. A subset of them will be made available to everyone. The collected data will be managed by the project coordinator and by the WP leaders, who will be responsible for granting access to them. VICE4RAIL will ensure a double process of project results sharing:

1. Internal data and information sharing, among VICE4RAIL project partners. The exchange of data, documents and deliverables will be ensured using the cooperation tool mentioned above.
2. External data sharing. Two different kinds of deliverables are foreseen:
 - a. Public Deliverables. All Public Deliverables will be made open, for consultation by everyone interested in having access to them, without restriction.
 - b. Confidential deliverables will be made available to Consortium partners as well as to the members of the Steering Committee and more in general to selected individual persons and legal entities after subscription of a Non-Disclosure Agreement.

As part of the activities devoted to Communication and Dissemination, the project Management will classify deliverables with potential IPR issues clearly identifying those that have to be classified as Confidential. They include those that must be disclosed in advance to future end users/stakeholders/service providers for supporting the successful VICE4RAIL platform market uptake. Patents and background of the partners which constitute the initial state of the art will be documented thoroughly in the Consortium Agreement. The Project Coordinator will help the consortium to outline how results will be identified for protection. The CA will further detail and fix how results will be protected, including details of cases for joint ownership.

#§CON-MET-CM§# #§COM-PL-CP§# #§REL-EVA-RE§#

2 **Impact** #@IMP-ACT-IA@#

The outcomes of the VICE4RAIL project will impact on closing the gaps yet preventing the adoption of the GNSS for the rollout of GNSS-based ERTMS solutions in Europe. It is poised to reverberate across the landscape of railway technologies, ushering in transformative changes in testing methodologies, certification processes, and the overall advancement of the industry. As the project unfolds, it promises to leave a lasting imprint on a permanent inclusion of GNSS technologies into the ERTMS architecture.

First and foremost, the testing environment proposed by VICE4RAIL represents a paradigm shift in the approach to evaluating and certifying railway technologies. The integration of real and synthetic sensor data, coupled with real-time closed-loop operations, not only enhances the realism of testing scenarios to consider the GNSS characteristics but also sets the stage for a faster certification process. This, in turn, directly impacts the credibility of GNSS technologies for the safety of railway systems, assuring stakeholders that new GNSS technologies undergo rigorous and dynamic testing before deployment. The project's exploration of GNSS performance and error modelling, especially in the context of local effects, addresses a critical aspect to certify satellite technologies according to the CENELEC norms. By advancing the understanding and modelling of multipath effects in a railway context, the project contributes to the development of more accurate and dependable GNSS-based localization for trains. This, in turn, will impact on the higher precision in planning train separation with shorter headways meaning higher capacity for railway operations, with positive implications for both passenger and freight transport. Indeed, GNSS is expected to play a crucial role as one of the elements of future train localisation systems, where GNSS receivers can be used in combination with other sources in a multi-sensor approach. GNSS-based train localisation systems make it possible to progressively remove balises, which are expensive to install and maintain, and thus provide a positive business case, reducing the investment and operational costs associated with ERTMS deployment. These benefits are crucial for the sustainability of the ERTMS, even more so in the context of the Italian large-scale ERTMS deployment plan which involves investing more than 13 billion euros to equip the entire Italian railway network (16.800 km) with ERTMS by 2036. This deployment plan is therefore creating an attractive and favourable environment for the introduction of GNSS-based location systems for which, however, the validation and certification procedures are crucial points that needs to be addressed to exploit GNSS technology within ERTMS.

Moreover, the project will complement and expand the Europe Rail R2DATO project and will contribute to the roadmap to release the new TSI for introducing the GNSS technology into the ERTMS standard. In essence, the impact of VICE4RAIL is two-fold: to close the gaps for the certification of GNSS in the ERTMS ecosystem and to ensure an early roll-out of GNSS-based ERTMS systems across Europe. It envisions a future where railway technologies are not only cutting-edge but also certified with a level of precision and realism that ensures their seamless integration into commercial lines. The project's ripple effect is anticipated to resonate in the certification practices, safety standards, and collaborative endeavours that shape the trajectory of the entire railway industry.

Through its comprehensive approach and forward-looking initiatives, VICE4RAIL aspires to leave an enduring legacy of innovation, safety, and efficiency in the realm of modern railway systems.

2.1 Project's pathways towards impact

The pathways towards impact in the VICE4RAIL project unfold through a series of strategic initiatives and collaborations that amplify the project's influence on the railway industry and beyond.

One crucial pathway is the establishment of a novel testing environment that seamlessly integrates real and synthetic sensor data. This not only ensures a credible certification of EGNSS technologies but also sets a precedent for future testing methodologies. As the project refines and validates this innovative approach on the Bologna San Donato Test Circuit, it becomes a blueprint for other testing facilities worldwide, potentially influencing industry standards for certification processes. The pathway to significant benefits is also through the proper evaluation of the GNSS continuity. Continuity has historically been one of the two main GNSS quality attributes on which the safety of air traffic management depends and is an important GNSS requirement that significantly affects the cost of the entire GNSS infrastructure. Therefore, when developing the certification plan within VICE4RAIL, GNSS continuity will be a major focus to meet the requirements for railway RAMS according to EN50126/EN50129 and automotive reliability (incorporating safety) according to ISO/TR 4804 for safe vehicle positioning. In this area, the path to impact will include investigating the origin of the continuity requirements, justifying the need for continuity in relation to the required safety concepts in the different transport sectors (rail, automotive, maritime) and proposing how to increase the system reliability to the required level.

Another pathway leads using regional and/or local GNSS augmentation in multimodal transport, not only in rail. Within VICE4RAIL, the aim is to compare certification practices in different transport sectors (rail, automotive, maritime) and to identify common elements of certification schemes that would simplify and facilitate the certification of GNSS-based positioning solutions. This can be achieved by comparing safety concepts, standards, directives, and regulations in the above-mentioned transport sectors. If certification relies on tests results, these results need to be as realistic as possible and at least represent the behaviour of the system in an operational use. The investigation on sensor error modelling will contribute to the acceptance of developed tool in an industry-accepted process. An important outcome will be the definition of scenarios and error test patterns to be employed required for certification.

2.1.1 Impact on Competitiveness of the European Railway Industry

At the heart of the project's impact lies a strategic initiative to enhance the competitiveness of the European railway industry. By championing the certification of train control systems that seamlessly integrate GNSS technologies, VICE4RAIL responds to critical gaps hindering widespread adoption. The project aligns seamlessly with the European industrial policy, recognized by the European Parliament, and propels the industry forward by expediting ERTMS roll-outs and elevating competitiveness on a global scale. The innovative approach of utilizing real-time Hybrid Virtualized Testing Certification Environment marks a paradigm shift. VICE4RAIL propels manufacturers and system integrators into an era of efficiency, allowing them to validate and optimize products within a dynamic testing framework. The project's commitment to adaptability, with the capacity to incorporate new GNSS signals and ERTMS specifications, positions the European railway industry as an agile player at the forefront of technological evolution. VICE4RAIL also contributes to increasing the competitiveness of railways through technology transfer from the field of automated car driving. This consists in exploiting synergies stemming from the similarities between rail and road transport in vehicle positioning based on GNSS, cameras, IMUs and other sensors and cutting-edge technologies, including the development of methods for safety demonstration such as verification and validation, development of safety case and certification. An illustrative example is the use of the automotive industry's years of experience in virtual validation of safety functions using various simulators. The competitiveness of railways will also be enhanced by VICE4RAIL through reducing the cost of railway infrastructure, which is addressed in this project by sharing a GNSS augmentation network for multiple transport sectors (rail, automotive, maritime). The basis of the multi-modal augmentation network is the regional augmentation from the SBAS family (1st tier), which can be used for the deployment of ERTMS with virtual balise also in markets outside Europe.

2.1.2 Market Impact: Factors for Market Uptake

As a catalyst for market uptake, VICE4RAIL introduces standardized certification procedures and dynamic testing environments for train control systems. Manufacturers and integrators, armed with these tools, gain a strategic edge in evaluating and fine-tuning product performance. The inclusion of EGNSS services and a standardizable augmentation network broadens market impact, ensuring compatibility with diverse GNSS technologies and addressing varied user needs. The collaborative efforts with standardization groups and rail system pillars exemplify a forward-thinking approach. VICE4RAIL actively contributes to the creation of standardized solutions, fostering an environment where industry players readily embrace certified GNSS-based train localization technologies. The project's commitment to scalability at an international level anticipates a global market embrace, aligning seamlessly with the interconnected nature of the rail industry. In essence, VICE4RAIL not only anticipates impact but actively shapes pathways towards it. The project's comprehensive approach, blending technological innovation, market foresight, and a deep understanding of regulatory landscapes, positions it as a transformative force in the evolving narrative of the European railway industry.

2.1.3 External Factors and Potential Barriers Analysis

The adoption of the GNSS technologies in the ERTMS system require consensus among the stakeholders, industry and agencies. The realization of the VICE4RAIL project's objectives is contingent upon its ability to effectively overcoming external factors and potential barriers demonstrating that a certification process is in place and the technology is mature. The synergy with the Pilot Line Novara-Rho commissioned by RFI to integrate the GNSS positioning into the ERTMS L2 and the expected liaison with the Europe Rail R2DATO project are a spectrum of elements, including regulatory changes both within and beyond the Horizon Europe framework. The convergence of different research and innovation endeavours is certainly a priority action of VICE4Rail project whose team includes two major railways operators, a certified ERTMS laboratory, two accredited Notify Bodies, three Research entities with more than 10 years' experience on GNSS for rail and a state-owned industry leading GNSS applications. This consortium is well balanced and motivated to catch the evolving landscape of ERTMS market, shifts in user behaviour, pushing ongoing technological developments, and leveraging the dynamics of international collaboration frameworks. The project recognizes the need for a proactive and adaptive approach to mitigate the impact of uncertainties. Strategies include maintaining a flexible methodology to swiftly adapt to regulatory changes, continually monitoring and aligning with related R&I initiatives, conducting thorough market analyses, and engaging with end-users to understand and respond to evolving needs, staying abreast of technological advancements that may influence project outcomes, and fostering and nurturing international collaborations to enhance knowledge exchange and harmonize efforts. These measures collectively aim to fortify the project's adaptability, resilience, and overall impact, ensuring that its outcomes remain pertinent, effective, and influential amid the dynamic landscape of the railway industry and associated technologies.

2.2 Measures to maximise impact – Dissemination, exploitation and communication #@COM-DIS-VIS-CDV@#

VICE4RAIL inherits the results of past and on-going projects which have demonstrated the technical and economic viability of using EGNSS in the context of the ERTMS namely, ERSAT EAV, HELMET funded by EUSPA, GATE4Rail funded by Shift2Rail. A specific liaison with the results of the GATE4Rail project will be pursued since it provided a laboratory test architecture capable of simulating railway scenarios for GNSS based ERTMS applications that allows to perform a zero on site testing including both the whole ETCS and the GNSS with global and local hazards. Synergies with the on-going ESA P-CAR project, aiming to create a virtualized test laboratory for multi-sensor positioning device validation in the automotive context will be exploited by VICE4RAIL project. The measures intended to maximise the impacts are first to liaise with the rail and space communities to allow a more efficient deployment of ERTMS with the virtualization of balises - a priority set by the Directive of European Parliament and in line with the ERTMS deployment strategy of RFI that is the potential early adopter. In this respect, a measure to maximise the impact is to establish a coordination through RFI with the Europe's Rail Joint Undertaking and the Novara – Rho pilot line commissioned by RFI for the assessment and certification plan related to the integration of the GNSS technology in the ERTMS L2 system. A specific liaison will be established with the RTCM SC 134 Standardization Group and with the Europe's Rail System Pillar regarding the utilization in the project of multi-modal augmentation network and certification paths by leveraging on Rail, Automotive and Maritime common user needs to achieve economy of scale. Regular link with R2DATO project, especially WP34/35 dedicated to

“testing, validation and certification” will be facilitated by SNCF and CEDEX partners.

The main objectives of the dissemination activities foreseen in the VICE4RAIL project are to:

- Promote VICE4RAIL solutions among the user communities.
- Contribute to the standardisation plans and key decision-making entities.
- Raise awareness about the need for a virtualized testing system for certification of EGNSS in Railway Train Positioning and get feedback about the VICE4RAIL results in the railway and space communities.
- Share know-how among researchers and provide further opportunities for cooperation at European level.

The dissemination will target different categories with different purposes. In Table 2, purposes of the dissemination activities versus audience categories are summarised.

Categories	Purposes	Actions
Railway and space communities	Raise awareness Demonstrate results Get feedback Align evolution roadmaps	Formulation of 3 yearly newsletters (M12, M24, M30), Organisation of two Workshops with key users, Agencies and Stakeholders. Submission of regular position papers to User Groups, Publication of papers on international journals, conferences, Website, Social Networks
Standardization Bodies	Inform, Promote, Get feedback	Active participation to the Standardization bodies, to horizontal RTCM SC 134, For implementing Integrity Augmentation Messages for a broad class of high-end receivers.
Internal audience	Inform Share know-how	Project meetings

Table 1: Dissemination Alignment: Purposes and Target Categories

Dissemination channels used to make VICE4RAIL results available to the target audience are listed in Table 3:

Actions	Description
Dedicated Workshops	Two workshops will be organized in the framework of the Project aiming to inform and get feedback from all interested parties on the achieved outcomes and results: one will be organized (M18) and one at the end of the project, a dedicated final event (M35) organized by RDL. Press releases will be published after all public events. Railway, space, and GNSS communities will be the main target of these workshops, to maintain VICE4RAIL oriented to users' needs.
Conference presentations	<p>The most important conferences in the fields of interest of the project will be considered to guarantee a proper visibility to the project activities and ongoing results. Among the others the following conferences will be considered:</p> <ul style="list-style-type: none"> • The International Rail Transport Conference ERRIC/IRFC • International Railway Summit (yearly - http://www.irits.org) • InnoTrans – International Trade Fair for Transport Technology – Innovative Components, Vehicles, Systems (biennial - http://www.innotrans.de/en) • European Space Solutions (yearly - http://www.european-space-solutions.eu) • Institute Of Navigation Conferences (e.g. ION PNT, ION GNSS+,...) • WCRR - World Congress on Railway research (biannual); • Transport Research Arena (TRA) • Munich Satellite Navigation Summit. • ITS World Congress. • IEEE International Conference. • European Navigation Conference (ENC) • ESREL – European Safety and Reliability Conference • COMPRAIL- International Conference on Railway Engineering Design and Operation. <p>The opportunity to organise a special session in a conference will be investigated</p>

Paper-publications	Submission of papers and interview to authoritative and influential journals on Transport.
Website & Social Networks	To create a reference point on the internet a project website will be built and updated. Periodic update of website contents will be performed. In addition, accounts for dissemination through Social Media (e.g., LinkedIn, Facebook,...) will be created.
Decision- making entities and associations	Liaisons with the following entities will be managed: ERTMS User Group, Europe's Rail JU and RTCM SC-134 "Integrity for GNSS-based High Accuracy Applications" standardisation Special Committee
Project Meetings	For each of the planned milestones, a Review Meeting will be held, with part of the sessions strictly dedicated to the discussion of technical aspects, so that exchange between partners will be not limited by the tasks assigned in WPs.

Table 2: Overview of Dissemination Channels

#§COM-DIS-VIS-CDV\$#

2.2.1 IPR Management

All issues regarding confidentiality, Intellectual Property Rights (IPR), Background, Side ground, Foreground, agreement on exploitation rights, and clarification of everyone's rights and obligations are going to be included in the Consortium Agreement (CA), a document to be signed by all partners before starting the project. The Project Manager is responsible for the use of IPR within the Consortium, according to the terms laid out in the CA and knowledge as well as the major principles on exploitation and dissemination issues, in case (see Figure 7). To carry out VICE4RAIL objectives, the partners will develop and share know-how and technologies in many forms, including, but not limited to processes, algorithms, tools, experiences, and methodologies. The know-how exchanged between the partners may include, in certain cases, background. The CA will be written in such a way that it is possible for all partners to carry out their project work whenever it is dependent on transfer of knowledge from other partners, whether this is foreground or background knowledge. The CA will protect the legitimate IP interests of all partners by explicitly limiting the rights to background knowledge and, where required, limiting the rights to foreground knowledge developed during the project when there is no need-to-know or need-to-use.

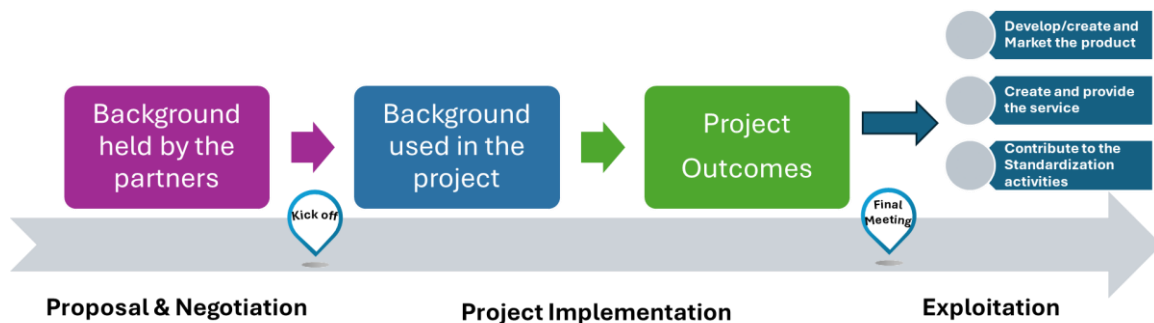


Figure 7: Management of IPR in VICE4RAIL

For the success of the project, all project partners agree on explicit rules concerning IP ownership, access rights to any Background and Foreground IP for the execution of the project and the protection of intellectual property rights (IPRs) and confidential information before the project starts. Therefore, such issues will be addressed in detail within the CA between all project partners. The main purpose of the CA is to establish a legal framework for the project to provide clear regulations for issues within the consortium related to the work, IP-Ownership, Access Rights to Background and Foreground IP for the duration of the project and any other matters of the consortium's interest. The terms in the CA deal with the protection of foreground related to joint invention, application for patents and further use of foreground. In addition to this, terms are defined for the access-rights to background and foreground, mainly based on the document on the provisions for implementing integrated projects. The CA – a legally binding document - deals with 1) Protection of individual partners pre-existing know-how. 2) Protection of IPR gained in the project. 3) Definition of the exploitation strategy (patents, licensing etc.). 4) A contingency plan that ensures the access to

foreground if a partner (with project critical IPR) leaves the consortium. Each project partner has the right to request access rights to the other project partners' background and results if it needs them to carry out its work under the project or to exploit its own results by request in writing and can be granted in any form. All the partners intend to pursue publications of the underlying principles of the technologies embodied in their tools in the appropriate academic conferences. Finally, all knowledge will be managed in accordance with the Grant Agreement. Regarding the management of data, the partners plan to set up a Data Management Plan (DMP) to provide an analysis of the main elements of the data management policy. The DMP will collect and analyse data collected during the project. Project data will be used both by the partners collecting and generating them and by other partners. The DMP will define how research data will be handled during the VICE4RAIL lifetime and after it is completed. It will be a dynamic document that will be delivered under the leadership of the coordinator and with strong involvement of the advisory group of the project. Special care will be taken to avoid obstructions to the exploitation of results. Partners, who own the rights of specific foreground developed in the project, are encouraged to exploit these results, licensing the results or at least transfer the rights in exchange for an appropriate financial compensation to partners willing to exploit the rights. The exploitation strategy of VICE4RAIL will ensure that the impact of the project outcomes is maximized during the project implementation and especially after the completion of the project activities in collaboration with the advisory groups. A further area of exploitation concerns the valuable knowledge generated during the project. In general, tools, methodology documents, benchmarks and case studies will be available to all; while some proprietary tools and algorithms developed by the partners may be available at the discretion and terms of their respective owners.

2.2.2 IP Ownership

Foreground IP shall be owned by the project partner carrying out the work leading to such Foreground IP. If any Foreground IP is created jointly by at least two project partners and it is not possible to distinguish between contributions of each project partner, such work will be jointly owned by the contributing partners. The same shall apply if, while carrying out work on the project, an invention is made having two or more contributing parties, and it is not possible to separate the individual contributions. Any such joint inventions and all related patent applications and patents shall be jointly owned by the contributing parties. Any details concerning the exposure to jointly owned Foreground IP, joint inventions and joint patent applications will be addressed in the CA.

2.2.3 Knowledge management and Open Access

A central aim of the VICE4RAIL project is to benefit the railway community with information that will help define the future and greater security of European railways. It is therefore necessary to enable publications to Open Access as much as possible. Researcher Infrastructures will contribute to access to peer-reviewed scientific publications, research data, and other research outputs free of charge in an open and non-discriminatory manner as early as possible in the dissemination process and enable the use and re-use of scientific research results, in line with the FAIR principles. The management of the digital research data generated in the action will be established on DMP.

#§COM-DIS-VIS-CDV§#

2.3 Summary

KEY ELEMENT OF THE IMPACT SECTION

SPECIFIC NEEDS	EXPECTED RESULTS	D & E & C MEASURES
<p>To close current gaps still preventing the adoption of GNSS for the ERTMS system there are needed:</p> <p>Certification Process: compliance with CENELEC norms.</p> <p>GNSS Performance assessment: To advance the understanding and modelling of GNSS and IMU performance, evaluating multipath effects and faults with very low probability of occurrence.</p> <p>Exploitation of EGNOS: usability of GNSS continuity designed for aviation to meet railway RAMS (EN 50126).</p> <p>Share- of best practices for standard multimodal applications: synergy for the certification process of GNSS in other transport means.</p>	<p>Certification Process in line with CENELEC norms: Reduced certification time and enhanced reliability in evaluating railway technologies.</p> <p>A Standardizable approach to:</p> <ol style="list-style-type: none"> Assess GNSS performance Use GNSS receivers Use interoperable Au-Network <p>Improved GNSS-based localization for trains, leading to enhanced safety and precision in railway operations.</p> <p>Hybrid Virtualised Test Bed</p> <ol style="list-style-type: none"> For supporting the certification To validate GNSS performance To scale at EU-Global level <p>Guidance and recommendations</p> <p>On the use of GNSS for ERTMS</p> <ol style="list-style-type: none"> certification of common elements Integrity Monitoring Au-networks 	<p>The dissemination campaign will:</p> <ul style="list-style-type: none"> promote VICE4RAIL certification platform among the rail user's community. contribute to the standardization plans and key decision-making entities (in particular RTCM SC134 and EUROPE RAIL JU); raise awareness about the need for about the need for a virtualized testing system for certification of EGNSS in Railway Train Positioning share know-how with researchers. <p>Two Dissemination events are planned, with the Railways users, agencies and stakeholders. A liaison will be established with the ERTMS User Group (EUG), the Europe's Rail Joint Undertaking (ERJU), RTCM SC-134 Special Committee and ESA/EUSPA. A Regular link with R2DATO project will be established. Results of the project will be disseminated to the potential users and stakeholders. Communication will be addressed to scientific journals and conferences and to the public opinion makers for the transport policy</p>

TARGET GROUPS

The target groups that will use or benefit from the results of the VICE4RAIL project include:

- **European Community** that funding the ERTMS and EGNSS infrastructures will gain economic and social benefits
- **ERTMS suppliers**
- **Satellite application providers**
- **Railway Infrastructure Managers**
- **Scientific Community** to lead at world-level research on GNSS technologies for railway applications.

OUTCOMES

By the end of the VICE4RAIL project, we anticipate the following outcomes:

- **Innovative Certification Testing Environment:** Establishment of a novel testing environment that seamlessly integrates real and synthetic sensor data, developing a dedicated circuit connected with the accredited ERTMS laboratory
- **Certification Procedures:** Introduction of standardized certification procedures and dynamic testing environments for train control systems, enhancing the efficiency and agility of manufacturers and system integrators.
- **Contribution to the Europe Rail R2DATO** project and to the **EUSPA roadmap** for accessing the railways market using EGNSS

IMPACTS

The expected change after successful dissemination and exploitation of project results:

- **Inclusion of EGNSS into ERTMS** as requested by EU Parliament directive
- **Use EGNSS infrastructures** for the ERTMS
- **New GNSS products**
- **Modal shifts** increase capacity to move people and goods to rail transport that is less polluting and more energy efficient than other means of transport
- **Global leadership for safer and autonomous driving:** export ERTMS and EGNSS know-how for autonomous cars and ships
- **Lower ERTMS Costs**

#§IMP-ACT-IA\$#

3 Quality and efficiency of the implementation # @QUA-LIT-QL@# # @WRK-PLA-WP@#

3.1 Work plan and resources

To meet the demanding objectives of the proposed project and consider the intricacies associated with the required activities, the work plan adheres to the European Parliament's resolution, emphasizing the necessity for synergies between ERTMS and EGNSS. Successful implementation is expected to expedite the ERTMS roll-out, reduce deployment costs, and enhance the global competitiveness of ERTMS. The primary concepts guiding the work plan are as follows:

- A hierarchical Work Breakdown Structure (WBS) has been devised and customized to allow:
 - the decomposition of the Project Scope into a set of simple and manageable sub-project scopes, with each well-defined sub-project scope corresponding to each Work Package (WP). Consequently, each WP has its designated WP Leader and a clearly defined scope with relationship dependencies.
 - A comprehensive, efficient, and effective monitoring and control mechanism for activities, achieved through hierarchical decomposition of WP activities into tasks. Each WP Task is overseen by a Task Leader responsible for ensuring the proper execution of their assigned task, under the full control and supervision of the WP Leader.
- WPs' hierarchical decomposition enables vertical traceability of activities and results across different WPs.

WBS is extended to two levels only (WP and Tasks inside the WP) for practical planning, monitoring, control, performance tracking, and to fulfil reporting requirements to the Project Coordinator, Project TMT, Project Steering Committee, and EUSPA. The WBS is shown in Figure 8 and detailed in Section 3.1.1.

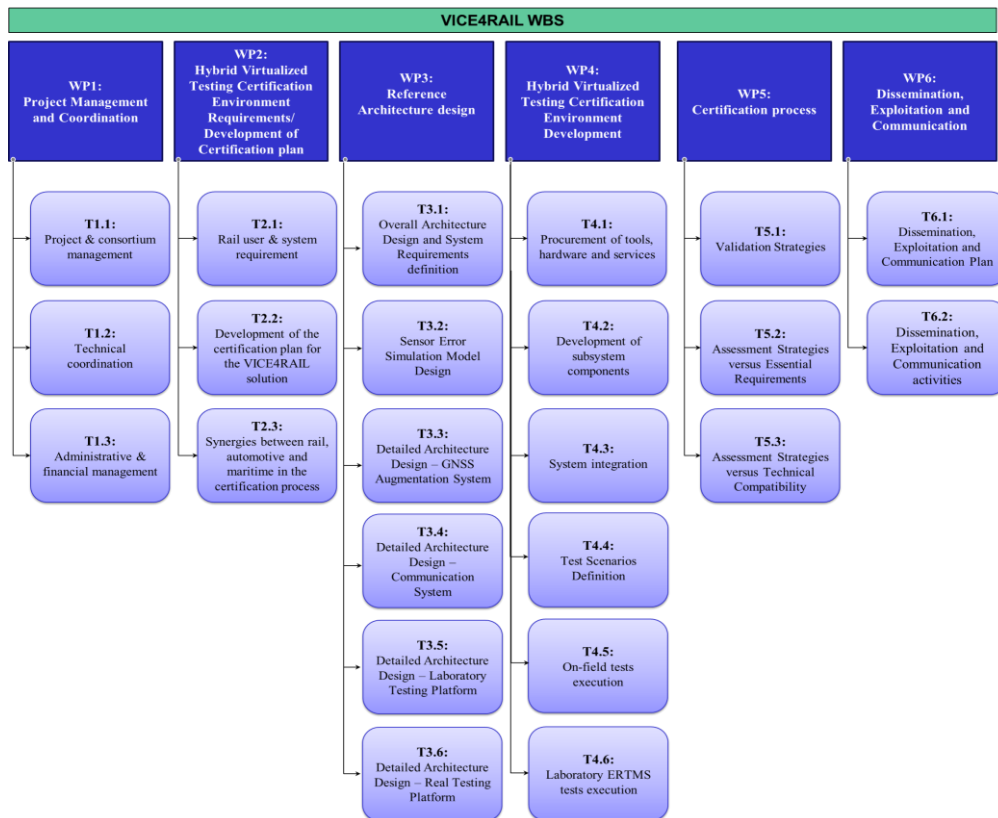


Figure 8: The VICE4RAIL WBS

The proposed activities are organized into the following WPs:

- WP1: Project Management and Coordination

- WP2: Hybrid Virtualized Testing Certification Environment Requirements/Development of Certification Plan
- WP3: Reference Architecture Design
- WP4: Hybrid Virtualized Testing Certification Environment Development
- WP5: Certification Process
- WP6: Dissemination, Exploitation and Communication

Gantt Chart

The efficient management of timing is essential for the successful implementation of our project objectives. In this section, we present a detailed overview, illustrated through a Gantt chart or a similar visual representation, that elucidates the temporal intricacies of each work package, emphasizing the strategic sequencing and interdependence of tasks. This deliberate approach aims to optimize project efficiency, foster collaboration, and ultimately contribute to the timely achievement of our overarching goals.

Project Plan

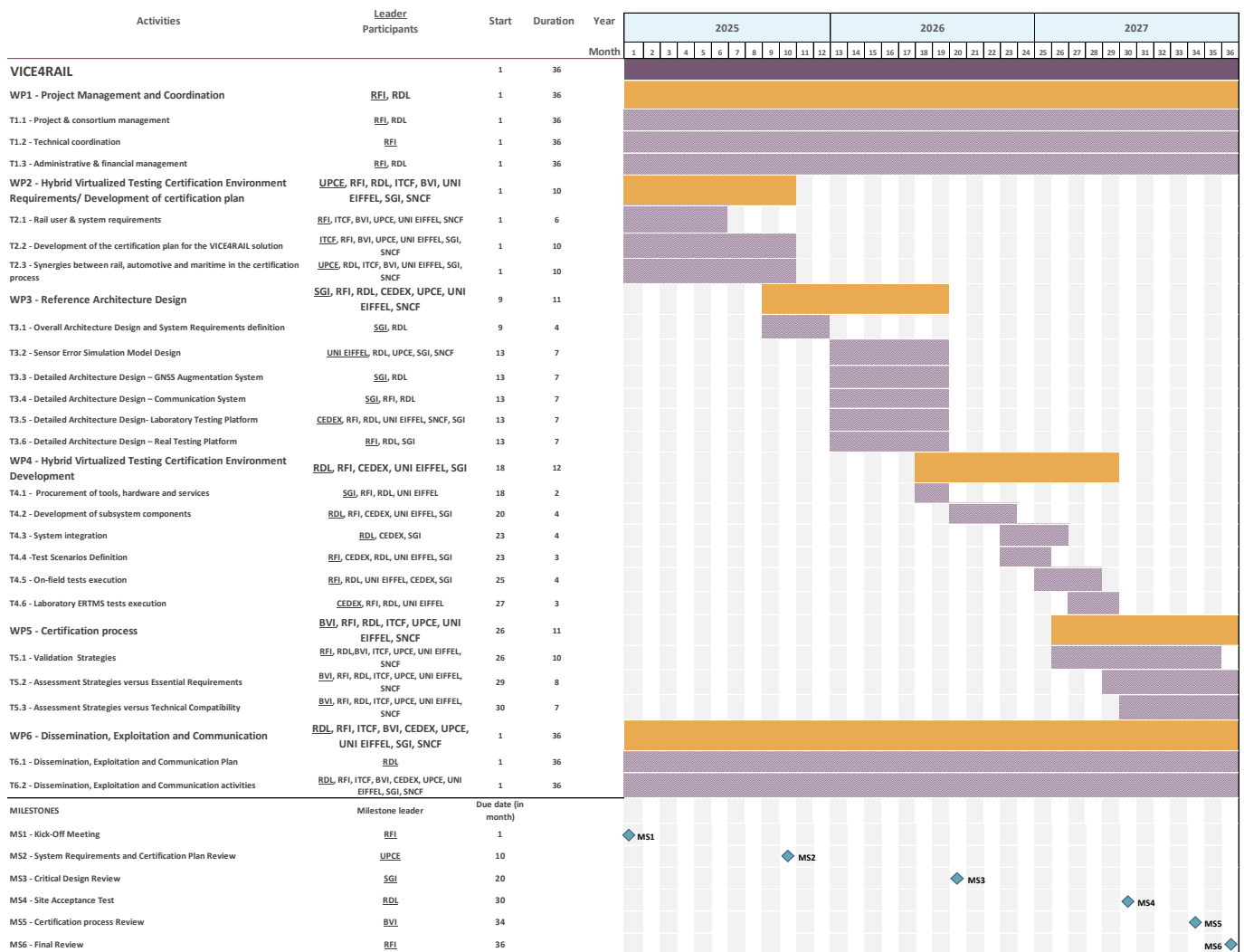


Figure 9: Gantt Chart

Within the framework of this project, a comprehensive graphical representation takes centre stage to illustrate the intricate interconnections among project components. It aims to provide a clear and concise overview of the relationships between various elements. WP1 and WP6 are two WPs executed in parallel from the project kick-off. WP1 will oversee performing the project monitoring and control, whereas WP6 will address the project dissemination

and communication activities. WP2 is devoted to specifying the requirements for the reference architecture design in WP3 and developing an industry-accepted certification plan to be used for architecture certification in WP5. Within WP 3 the System Requirements, Overall Architecture and Detailed Architecture and relevant Test Plan are designed for the Laboratory Test Platform and the On field/Mixed Reality Testing Platform. WP 4 implements the designed architecture and performs Unit Test, Integration Test and the Execution of Real Platform Test.

Based on the detailed design of the architecture for the HyVICE platform carried out in WP3, WP4 is devoted to the development of each subsystem and their integration and testing in laboratory and on-field. Results of both laboratory and field tests are used in WP5 to conduct the final validation of HyVICE Platform. In WP5 Applicant/Manufacturer define the validation strategies to issue a draft or a simple template of main validation documents/ evidence. The No.Bo. is involved, according to his accredited role, to simulate a possible full certification process evaluating the conformity of the Essential Requirements and the Technical compatibility for the trackside and on-board system.

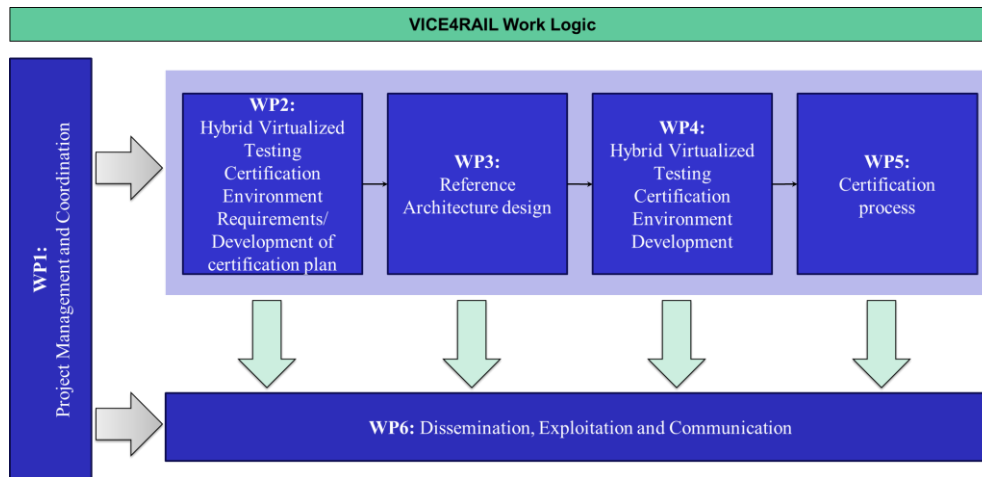


Figure 10: VICE4RAIL Study Logic

3.1.1 ‘Purchase costs’ items (travel and subsistence, equipment and other goods, works and services)

Participant N°1 / RFI		
	Cost (€)	Justification
Travel and subsistence	11.000	Travel for coordination meetings: KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Equipment	50.000	Purchase of equipment for setting up the Bologna San Donato circuit on-board and the wayside equipment including RF GNSS + 4G/5G Wires, Data logger, PC rugged elaboration, Rack 19" 20U
Other goods, works and services	90.000	Train test rent, Conference Participation, Dissemination on WP6
Total	151.000	

Participant N°2 / RDL		
	Cost (€)	Justification
Subcontract	50.000	Technical service for carrying out the installation of on-board and the

		wayside equipment as detailed in section 1.2.2.1
Travel and subsistence	10.000	Travel for coordination meetings: KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Equipment	100.000	Purchase of UWB Localization system, Optoelectronics devices, WAN infrastructure, Modem WAN 4G/5G, GNSS Receiver, GNSS antenna, IMU, atomic clock, as detailed in section 1.2.2.1
Other goods, works and services	35.000	Emdesk Tool, Conference Participation, Publications fees; CFS; 2 Workshop Organization; Dissemination on WP6, Catering for meetings; Project Identity and Logo; Public website (design, operation, and maintenance of a web-site portal), Project Leaflets, Project KOM, Final Project Conference, External events, publication on magazines, exhibition booths, and conferences.
Total	195.000	

Participant N°3 / ITCF		
	Cost (€)	Justification
Travel and subsistence	6.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Total	6.000	

Participant N°4 /BVI		
	Cost (€)	Justification
Subcontract	30.000	Consultant involved for support related to technical documentation evaluation and test witnessing involved in WP2, WP3 and WP6 with an effort of about 3 PM
Travel and subsistence	6.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Total	36.000	

Participant N°5 / CEDEX		
	Cost (€)	Justification
Travel and subsistence	8.000	KOM, Technical meetings, Dissemination meetings, Final Review
Total	8.000	

Participant N°6 / UPCE		
	Cost (€)	Justification
Travel and subsistence	4.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review

Other goods, works and services	1.500	Conference Participation, Publications fees;
Total	5.500	

Participant N°7 / UNI. EIFFEL		
	Cost (€)	Justification
Travel and subsistence	6.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Other goods, works and services	2.000	Conference Participation, Publications fees;
Total	8.000	

Participant N°8 / SGI		
	Cost (€)	Justification
Travel and subsistence	8.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Equipment	7.500	Reference station
Other goods, works and services	4.500	Conference Participation, Publications fees;
Total	20.000	

Participant N°9 / SNCF		
AE: SNCF -V	Cost (€)	Justification
Travel and subsistence	4.000	KOM, Technical meetings, Dissemination meetings, on field tests and Final Review
Total	4.000	

3.1.2 'Other costs categories' items (e.g. internally invoiced goods and services)

Participant Number/Short Name		
CEDEX	Cost (€)	Justification
Internally invoiced goods and services	61.600	Use of ERTMS labs - lab test benches (OBU +RBC) 2 months= 44 days

Participant Number/Short Name		
RFI	Cost (€)	Justification
Internally invoiced goods and services	60.000	Use of Bologna San Donato Circuit 2 weeks = 10 days

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3.2 Capacity of participants and consortium as a whole #@CON-SOR-CS@# #@PRJ-MGT-PM@#

Under the coordination of the Italian Infrastructure Manager RFI, and with technical and administrative support from RDL, the consortium is primarily formed based on the longstanding collaborative relationship among all its partners. This multidisciplinary group is composed by leading railways infrastructure managers

in addition to leaders in testing, inspection, and certification services, highly skilled SMEs, and three research institutions with multi-year expertise in this field.

The consortium involves Rail Infrastructure managers and Train operators which are the potential

beneficiaries of this technology together with NoBos, Assessor the Accredited ERTMS laboratory and research organizations from five EU countries, involving participants from both industry and academia.

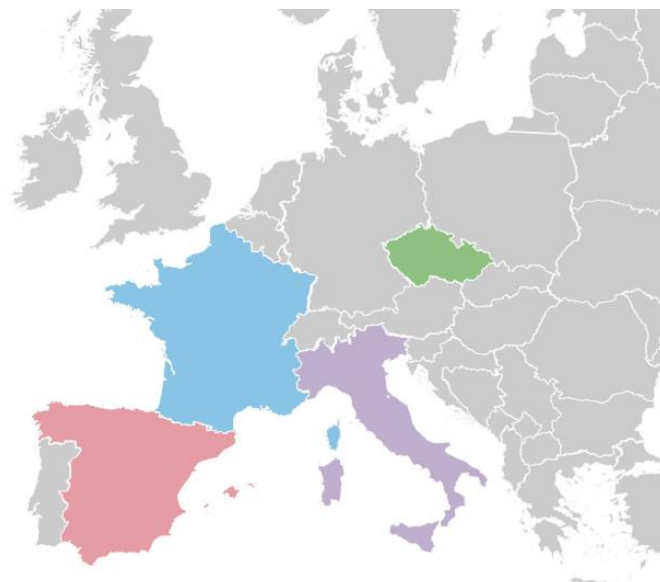


Figure 11: Composition of the VICE4RAIL Consortium and Partner Geographical Distribution

Participants in the VICE4RAIL Consortium:

- **RFI (IT)** : Infrastructure Manager of railway lines, RFI provides railway companies with access to the Italian rail network. RFI is involved since 2012 on R&D projects with EUSPA and ESA for GNSS applications, being the Satellite Game Changer for the satellite technologies for the ERTMS and partner of the Europe's Rail Joint Undertaking. RFI is the consortium coordinator and it will provide the test circuits on the S.Donato line and contribute to the validation strategy and assessment of results
- **Radiolabs (IT)**: Non-profit organization with experience on high integrity satellite navigation, telecommunication, and cyber secure technologies. RDL has participated and coordinated several H2020, ESA and Shift2Rail projects by 2012 among the others HELMET (multi-modal network), P-CAR (PNT laboratory for testing and validation of Connected Autonomous Driving functions) and GATE4Rail (zero on-site testing simulation and verification platform). Radiolabs will lead the Hybrid Virtualized Testing Certification Environment development and the Dissemination Exploitation and Communication activities.
- **Italcertifier (IT)**: Notified Body (NoBo) accredited by the Italian Ministry of Transport and Infrastructure to certify railway subsystems and interoperability components, ITCF is recognized by the Italian Rail Safety National Agency (ANSFISA) as Independent Safety Assessor (ISA) and is accredited as Product Certification Body (UNI EN ISO 17065) and Inspection Body (UNI CEI IEC EN/ISO 17020 type "A"). Italcertifier will contribute to the certification process being already involved into the Pilot Line Novara-Rho of RFI.
- **Bureau Veritas (IT)**: is a company of the Bureau Veritas Group, leader in testing, verification and certification services for Quality, Health and Safety, Environment and Social Responsibility (QHSE-SA). Designated Body (DeBo) in Italy and India ; Assessment Body (AsBo) recognized by Italian Ministry of Infrastructure and Transport; Notified Body (NoBo) No. 1370 ; Product Certification Body UNI CEI EN 17065 recognized by ACCREDIA; BVI will be leading the certification process.
- **CEDEX (ES)**: Is a non-profit public body belonging to the Ministry of Transports and Sustainable Mobility of Spain regarding research, development, innovation and technical assistance in the fields of Transport, Public works and its environment. It consists of seven departments dealing with Railway Interoperability, Geotechnics, Transport, Hydrology, Coasts and Ports, Structures and Materials, and Applied Technical Studies. CEDEX host the Rail interoperability lab, which is the first lab in Europe in testing ETCS components and subsystems. This lab has tested most of the ETCS lines (both L1 and L2) in service in Spain and therefore has a very mature experience in testing ETCS al lab, providing an excellent platform for developing virtual certification of ETCS new components too.
- **University of Pardubice (CZ)**: with 8000 students is a medium-sized public university out of all 26 in the country. In cooperation with Czech Railways, UPCE has started R&D activities in the field of EGNOS applications for railway signalling within the EU APOLO project (1998-2001). Recently, the Faculty of Electrical

Engineering and Informatics (FEI) of UPCE has been involved in the projects H2020 RHINOS (2016-2017) ESA STEMS (2018-2020) and H2020 HELMET (2020-2022). UPCE FEI will contribute by specifying requirements, defining certification procedures, and identifying synergies for multimodal transport applications.

- **Université Gustave Eiffel (FR):** University created in 2020 combining a university, schools and a research centre, with the aim of transforming life and cities, committed to the theme of sustainable cities and represent, by itself, a quarter of French research in this field. The COSYS department of research has a long experience in EU projects dealing with certification methodologies and contributions to the development of GNSS integration in rail with participation to Shif2Rail and Europe's Rail projects, as well as recent GATE4Rail, RAILGAP, or Pods4Rail. Uni. Eiffel will contribute to certification methodologies and GNSS local error simulation.
- **SOGEI (IT):** is the ICT partner of the Ministry of Economy and Finance of Italy, serving by more than thirty years the Italian Institutions with GNSS related Services (Cadastre, Customs, Asset management). By years, Sogei, through its R&S department, is managing GRDNet (GNSS R&D Network), and augmentation network having worked on several Horizon2020 Projects concerning Rail and Automotive GNSS High Accuracy and High Integrity and Galileo HAS applications (ERSAT-EAV, RHINOS, HELMET, GISCAD-OV). Sogei will be leading the Reference Architecture design.
- **SNCF (FR):** SNCF Group is a global leader in passenger and freight transport services, including management of the French rail network. Its revenue totalled €41.4 billion in 2022, with international markets accounting for nearly 40%. The Group does business in 120 countries and has 276,000 employees, with over half in its core rail business and nearly 210,000 working in France. The Group consists of a parent (SNCF Holding) and five subsidiaries including SNCF Voyageurs. SNCF Voyageurs is operating an ERTMS Rail Lab hosting several test facilities and test benches. SNCF teams are regularly performing also on-site tests on commercial trains or lab trains. SNCF Voyageurs is highly involved in R2DATO testing thanks to its ETCS certification laboratory. SNCF Voyageurs contribution will be essential to create synergy between VICE4RAIL and R2DATO WP34/35.

Overall, VICE4RAIL team has a multi-year experience on GNSS-based ERTMS research and is motivated to close the gaps for the certification process by exploiting the results of national initiatives and assets and to contribute to the Europe Rail R2DATO project and the roadmap for using the EGNSS infrastructures.

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4 Ethics self-assessment

Ethics Issues Table

1. Human Embryonic Stem Cells and Human Embryos		Page
Does this activity involve Human Embryonic Stem Cells (hESCs)?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve the use of human embryos?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
2. Humans		Page
Does this activity involve human participants?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve interventions (physical also including imaging technology, behavioural treatments, etc.) on the study participants?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve conducting a clinical study as defined by the Clinical Trial Regulation (EU 536/2014) ? (using pharmaceuticals, biologicals, radiopharmaceuticals, or advanced therapy medicinal products)	<input type="radio"/> Yes <input checked="" type="radio"/> No	
3. Human Cells / Tissues (not covered by section 1)		Page
Does this activity involve the use of human cells or tissues?	<input type="radio"/> Yes <input checked="" type="radio"/> No	

4. Personal Data		Page
Does this activity involve processing of personal data?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve further processing of previously collected personal data (including use of preexisting data sets or sources, merging existing data sets)?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Is it planned to export personal data from the EU to non-EU countries?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Is it planned to import personal data from non-EU countries into the EU or from a non-EU country to another non-EU country?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve the processing of personal data related to criminal convictions or offences?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
5. Animals		Page
Does this activity involve animals?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
6. Non-EU Countries		Page
Will some of the activities be carried out in non-EU countries?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
In case non-EU countries are involved, do the activities undertaken in these countries raise potential ethics issues?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
It is planned to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Is it planned to import any material (other than data) from non-EU countries into the EU or from a non-EU country to another non-EU country? For data imports, see section 4.	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Is it planned to export any material (other than data) from the EU to non-EU countries? For data exports, see section 4.	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve low and/or lower middle income countries , (if yes, detail the benefit-sharing actions planned in the self-assessment)	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Could the situation in the country put the individuals taking part in the activity at risk?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
7. Environment, Health and Safety		Page
Does this activity involve the use of substances or processes that may cause harm to the environment, to animals or plants.(during the implementation of the activity or further to the use of the results, as a possible impact) ?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity deal with endangered fauna and/or flora / protected areas?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Does this activity involve the use of substances or processes that may cause harm to humans, including those performing the activity.(during the implementation of the activity or further to the use of the results, as a possible impact) ?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
8. Artificial Intelligence		Page
Does this activity involve the development, deployment and/or use of Artificial Intelligence-based systems?	<input type="radio"/> Yes <input checked="" type="radio"/> No	
9. Other Ethics Issues		Page
Are there any other ethics issues that should be taken into consideration?	<input type="radio"/> Yes <input checked="" type="radio"/> No	

5 **History Of Changes**

HISTORY OF CHANGES		
VERSION	DATE	DESCRIPTION
V1	16/07/2024	First release

ANNEX 2

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible ¹ costs (per budget category)										Estimated EU contribution ²				
	Direct costs									Indirect costs	Total costs	EU contribution to eligible costs			Maximum grant amount ⁶
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories	E. Indirect costs ³	Funding rate % ⁴		Maximum EU contribution ⁵	Requested EU contribution		
	A.1 Employees (or equivalent)		A.4 SME owners and natural person beneficiaries	A.6 Personnel unit cost	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	E. Indirect costs					
A.2 Natural persons under direct contract															
A.3 Seconded persons															
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs ⁷	Unit costs ⁷	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs (usual accounting practices)	Flat-rate costs ⁸					
	a1	a2	a3	a5	b	c1	c2	c3	d2	e = 0,25 * (a1 + a2 + a3 + a5 + c1 + c2 + c3)	f= a+b+c+d+e	U	g = f * U%	h	m
1 - RFI	280 600.00	0.00	0.00	0.00	0.00	11 000.00	50 000.00	90 000.00	60 000.00	107 900.00	599 500.00	70	419 650.00	419 650.00	419 650.00
2 - RDL	350 000.00	0.00	0.00	0.00	50 000.00	10 000.00	100 000.00	35 000.00	0.00	123 750.00	668 750.00	100	668 750.00	668 750.00	668 750.00
3 - ITCF	146 832.00	0.00	0.00	0.00	0.00	6 000.00	0.00	0.00	0.00	38 208.00	191 040.00	70	133 728.00	133 728.00	133 728.00
4 - BVI	146 300.00	0.00	0.00	0.00	30 000.00	6 000.00	0.00	0.00	0.00	38 075.00	220 375.00	70	154 262.50	154 262.50	154 262.50
5 - CEDEX	120 000.00	0.00	0.00	0.00	0.00	8 000.00	0.00	0.00	61 600.00	32 000.00	221 600.00	100	221 600.00	221 600.00	221 600.00
6 - UPCE	141 120.00	0.00	0.00	0.00	0.00	4 000.00	0.00	2 000.00	0.00	36 780.00	183 900.00	100	183 900.00	183 900.00	183 900.00
7 - UNI EIFFEL	146 460.00	0.00	0.00	0.00	0.00	6 000.00	0.00	2 000.00	0.00	38 615.00	193 075.00	100	193 075.00	193 075.00	193 075.00
8 - SGI	216 000.00	0.00	0.00	0.00	0.00	8 000.00	7 500.00	4 500.00	0.00	59 000.00	295 000.00	70	206 500.00	206 500.00	206 500.00
9 - SNCF	18 840.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4 710.00	23 550.00	70	16 485.00	16 485.00	16 485.00
9.1 - SNCF VOYAGEURS	75 357.00	0.00	0.00	0.00	0.00	4 000.00	0.00	0.00	0.00	19 839.25	99 196.25	70	69 437.38	69 437.38	69 437.38
Total consortium	1 641 509.00	0.00	0.00	0.00	80 000.00	63 000.00	157 500.00	133 500.00	121 600.00	498 877.25	2 695 986.25		2 267 387.88	2 267 387.88	2 267 387.88

¹ See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).

² The consortium remains free to decide on a different internal distribution of the EU funding (via the consortium agreement; see Article 7).

³ Indirect costs already covered by an operating grant (received under any EU funding programme) are ineligible (see Article 6.3). Therefore, a beneficiary/affiliated entity that receives an operating grant during the action duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please immediately contact us via the EU Funding & Tenders Portal for details.

⁴ See Data Sheet for the funding rate(s).

⁵ This is the theoretical amount of the EU contribution to costs, if the reimbursement rate is applied to all the budgeted costs. This theoretical amount is then capped by the 'maximum grant amount'.

⁶ The 'maximum grant amount' is the maximum grant amount decided by the EU. It normally corresponds to the requested grant, but may be lower.

⁷ See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).

⁸ See Data Sheet for the flat-rate.

ANNEX 2a

ADDITIONAL INFORMATION ON UNIT COSTS AND CONTRIBUTIONS

SME owners/natural person beneficiaries without salary

See [*Additional information on unit costs and contributions \(Annex 2a and 2b\)*](#)

HE and Euratom personnel unit cost

See [*Additional information on unit costs and contributions \(Annex 2a and 2b\)*](#)

HE and Euratom Research Infrastructure actions

See [*Additional information on unit costs and contributions \(Annex 2a and 2b\)*](#)

Euratom staff mobility costs

See [*Additional information on unit costs and contributions \(Annex 2a and 2b\)*](#)

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CONSORZIO UNIVERSITA INDUSTRIA - LABORATORI DI RADIOCOMUNICAZIONI I (RDL), PIC 999585971, established in CORSO D ITALIA 19, ROMA 00198, Italy,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ITALCERTIFER SOCIETA PER AZIONI (ITCF), PIC 996654340, established in LARGO FRATELLI ALINARI 4, FLORENCE 50123, Italy,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

BUREAU VERITAS ITALIA SPA (BVI), PIC 913300300, established in VIALE MONZA 347, MILANO 20126, Italy,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CENTRO DE ESTUDIOS Y EXPERIMENTACION DE OBRAS PUBLICAS (CEDEX), PIC
999455312, established in ALFONSO XII 3, MADRID 28014, Spain,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERZITA PARDUBICE (UPCE), PIC 999453663, established in Studentska 95, PARDUBICE 532 10, Czechia,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITE GUSTAVE EIFFEL (UNI EIFFEL), PIC 897556521, established in 5 BOULEVARD DESCARTES CAMPUS DE MARNE-LA-VALLE, MARNE-LA-VALLEE 77454, France,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SOGEL-SOCIETA GENERALE D'INFORMATICA SPA (SGI), PIC 949108723, established in VIA MARIO CARUCCI 99, ROMA 00143, Italy,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SOCIETE NATIONALE SNCF (SNCF), PIC 999941767, established in 2 PLACE AUX ETOILES,
ST DENIS 93200, France,

hereby agrees

to become beneficiary

in Agreement No 101180124 — VICE4RAIL ('the Agreement')

between RETE FERROVIARIA ITALIANA (RFI) and European Union Agency for the Space Programme ('granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 4 HORIZON EUROPE MGA — MULTI + MONO

FINANCIAL STATEMENT FOR [PARTICIPANT NAME] FOR REPORTING PERIOD [NUMBER]

		Eligible ¹ costs (per budget category)																EU contribution ²					Revenues	
		Direct costs														Indirect costs		Total costs	EU contribution to eligible costs			Total requested EU contribution	Income generated by the action	
		A. Personnel costs			B. Subcontracting costs		C. Purchase costs			D. Other cost categories						E. Indirect costs ²	Funding rate % ³		Maximum EU contribution ⁴	Requested EU contribution				
		A.1 Employees (or equivalent)	A.4 SME owners and natural person beneficiaries	A.6 Personnel unit cost	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.1 Financial support to third parties ¹	D.2 Internally invoiced goods and services	D.3 Transnational access to research infrastructure unit costs ¹	D.4 Virtual access to research infrastructure unit costs ¹	[OPTION for HE PCPJ/PPJ: D.5 PCPJ/PPJ procurement costs ¹]	[OPTION for Euratom Programme Cofund Actions: D.6 Euratom Cofund staff mobility costs ¹]	[OPTION for HE ERC Grants: D.7 ERC additional funding ¹]	[OPTION for HE ERC Grants: D.8 ERC additional funding (subcontracting, FSTP and internally invoiced goods and services) ¹]	E. Indirect costs							
Forms of funding		Actual costs	Unit costs (usual accounting practices)	Unit costs ⁵	Unit costs ⁵	Actual costs	Actual costs	Actual costs	Actual costs	/ Actual costs ¹	Unit costs (usual accounting practices)	/ Unit costs ⁵	/ Unit costs ⁵	/ Actual costs ¹	/ Unit costs ⁵	/ Actual costs ¹	/ Actual costs ¹	Flat-rate costs ⁶						
		a1	a2	a3	a5	b	c1	c2	c3	/ d1a/	d2	/ d3/	/ d4/	/ d5/	/ d6/	/ d7/	/ d8/	$\frac{e = c1 + c2 + c3 + d3a + d3b + d3c + d3d + f + d3g}{f + d8g}$	$f = a+b+c+d+e$	U	g = f*U%	h	m	n
XX – [short name beneficiary/affiliated entity]																								

The beneficiary/affiliated entity hereby confirms that:

The information provided is complete, reliable and true.

The costs and contributions declared are eligible (see Article 6).

The costs and contributions can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 19, 20 and 25).

For the last reporting period: that all the revenues have been declared (see Article 22).

Ⓓ Please declare all eligible costs and contributions, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace costs/contributions that are found to be ineligible.

¹ See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).

² If you have also received an EU operating grant during this reporting period, you cannot claim indirect costs - unless you can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please contact us immediately via the Funding & Tenders Portal for details.

³ See Data Sheet for the reimbursement rate(s).

⁴ This is the *theoretical* amount of EU contribution to costs that the system calculates automatically (by multiplying the reimbursement rates by the costs declared). The amount you request (in the column 'requested EU contribution') may be less.

⁵ See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).

⁶ See Data Sheet for the flat-rate.

ANNEX 5

SPECIFIC RULES

CONFIDENTIALITY AND SECURITY (— ARTICLE 13)

Sensitive information with security recommendation

Sensitive information with a security recommendation must comply with the additional requirements imposed by the granting authority.

Before starting the action tasks concerned, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task. The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary.

For requirements restricting disclosure or dissemination, the information must be handled in accordance with the recommendation and may be disclosed or disseminated only after written approval from the granting authority.

EU classified information

If EU classified information is used or generated by the action, it must be treated in accordance with the security classification guide (SCG) and security aspect letter (SAL) set out in Annex 1 and Decision 2015/444¹ and its implementing rules — until it is declassified.

Deliverables which contain EU classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving EU classified information may be subcontracted only with prior explicit written approval from the granting authority and only to entities established in an EU Member State or in a non-EU country with a security of information agreement with the EU (or an administrative arrangement with the Commission).

EU classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS (— ARTICLE 14)

Ethics and research integrity

The beneficiaries must carry out the action in compliance with:

- ethical principles (including the highest standards of research integrity)

¹ Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

and

- applicable EU, international and national law, including the EU Charter of Fundamental Rights and the European Convention for the Protection of Human Rights and Fundamental Freedoms and its Supplementary Protocols.

No funding can be granted, within or outside the EU, for activities that are prohibited in all Member States. No funding can be granted in a Member State for an activity which is forbidden in that Member State.

The beneficiaries must pay particular attention to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- aim at human cloning for reproductive purposes
- intend to modify the genetic heritage of human beings which could make such modifications heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed)
- intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer, or
- lead to the destruction of human embryos (for example, for obtaining stem cells).

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the granting authority.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity².

This implies compliance with the following principles:

- reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources
- honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way
- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment

² European Code of Conduct for Research Integrity of ALLEA (All European Academies).

- accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the Code.

Activities raising ethical issues must comply with the additional requirements formulated by the ethics panels (including after checks, reviews or audits; see Article 25).

Before starting an action task raising ethical issues, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task, notably from any (national or local) ethics committee or other bodies such as data protection authorities.

The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary, which shows that the documents cover the action tasks in question and includes the conclusions of the committee or authority concerned (if any).

VALUES (— ARTICLE 14)

Gender mainstreaming

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action and, where applicable, in line with the gender equality plan. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE (— ARTICLE 16)

Definitions

Access rights — Rights to use results or background.

Dissemination — The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.

Exploit(ation) — The use of results in further research and innovation activities other than those covered by the action concerned, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

Fair and reasonable conditions — Appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

FAIR principles — ‘findability’, ‘accessibility’, ‘interoperability’ and ‘reusability’.

Open access — Online access to research outputs provided free of charge to the end-user.

Open science — An approach to the scientific process based on open cooperative work, tools and diffusing knowledge.

Research data management — The process within the research lifecycle that includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing.

Research outputs — Results to which access can be given in the form of scientific publications, data or other engineered results and processes such as software, algorithms, protocols, models, workflows and electronic notebooks.

Scope of the obligations

For this section, references to ‘beneficiary’ or ‘beneficiaries’ do not include affiliated entities (if any).

Agreement on background — Background free from restrictions

The beneficiaries must identify in a written agreement the background as needed for implementing the action or for exploiting its results.

Where the call conditions restrict control due to strategic interests reasons, background that is subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions and that impact the exploitation of the results (i.e. would make the exploitation of the results subject to control or restrictions) must not be used and must be explicitly excluded in the agreement on background — unless otherwise agreed with the granting authority.

Results free from restrictions

Where the call conditions restrict control due to strategic interests reasons, the beneficiaries must ensure that the results of the action are not subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions — unless otherwise agreed with the granting authority.

Ownership of results

Results are owned by the beneficiaries that generate them.

However, two or more beneficiaries own results jointly if:

- they have jointly generated them and
- it is not possible to:
 - establish the respective contribution of each beneficiary, or
 - separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree — in writing — on the allocation and terms of exercise of their joint ownership (‘joint ownership agreement’), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement or consortium agreement, each joint owner may grant non-exclusive licences to third parties to exploit the jointly-owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

The joint owners may agree — in writing — to apply another regime than joint ownership.

If third parties (including employees and other personnel) may claim rights to the results, the beneficiary concerned must ensure that those rights can be exercised in a manner compatible with its obligations under the Agreement.

The beneficiaries must indicate the owner(s) of the results (results ownership list) in the final periodic report.

Protection of results

Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests.

Exploitation of results

Beneficiaries which have received funding under the grant must — up to four years after the end of the action (see Data Sheet, Point 1) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must (unless otherwise agreed in writing with the granting authority) use the Horizon Results Platform to find interested parties to exploit the results.

If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement (see Article 17) in (information related to) the standard.

Additional exploitation obligations

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action (see Data Sheet, Point 1).

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Additional information obligation relating to standards

Where the call conditions impose additional information obligations relating to possible standardisation, the beneficiaries must — up to four years after the end of the action (see Data Sheet, Point 1) — inform the granting authority, if the results could reasonably be expected to contribute to European or international standards.

Transfer and licensing of results

Transfer of ownership

The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licences

The beneficiaries may grant licences to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations.

Exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights.

Granting authority right to object to transfers or licensing — Horizon Europe actions

Where the call conditions in Horizon Europe actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated with Horizon Europe, and
- the granting authority considers that the transfer or licence is not in line with EU interests.

Beneficiaries that intend to transfer ownership or grant an exclusive licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations.

The granting authority may request additional information.

If the granting authority decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Granting authority right to object to transfers or licensing — Euratom actions

Where the call conditions in Euratom actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive or non-exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated to the Euratom Research and Training Programme 2021-2025 and
- the granting authority considers that the transfer or licence is not in line with the EU interests.

Beneficiaries that intend to transfer ownership or grant a licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the results, the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations (including the defence interests of the EU Member States under Article 24 of the Euratom Treaty).

The granting authority may request additional information.

If the granting authority decides to object to a transfer or licence, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Limitations to transfers and licensing due to strategic assets, interests, autonomy or security reasons of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security reasons, the beneficiaries may not transfer ownership of their results or grant licences to third parties which are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless they have requested and received prior approval by the granting authority.

The request must:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or license on the strategic assets, interests, autonomy or security of the EU and its Member States.

The granting authority may request additional information.

Access rights to results and background

Exercise of access rights — Waiving of access rights — No sub-licensing

Requests to exercise access rights and the waiver of access rights must be in writing.

Unless agreed otherwise in writing with the beneficiary granting access, access rights do not include the right to sub-license.

If a beneficiary is no longer involved in the action, this does not affect its obligations to grant access.

If a beneficiary defaults on its obligations, the beneficiaries may agree that that beneficiary no longer has access rights.

Access rights for implementing the action

The beneficiaries must grant each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- informed the other beneficiaries that access to its background is subject to restrictions, or
- agreed with the other beneficiaries that access would not be on a royalty-free basis.

The beneficiaries must grant each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

Access rights for exploiting the results

The beneficiaries must grant each other access — under fair and reasonable conditions — to results needed for exploiting their results.

The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for entities under the same control

Unless agreed otherwise in writing by the beneficiaries, access to results and, subject to the restrictions referred to above (if any), background must also be granted — under fair and reasonable conditions — to entities that:

- are established in an EU Member State or Horizon Europe associated country
- are under the direct or indirect control of another beneficiary, or under the same direct or indirect control as that beneficiary, or directly or indirectly controlling that beneficiary and
- need the access to exploit the results of that beneficiary.

Unless agreed otherwise in writing, such requests for access must be made by the entity directly to the beneficiary concerned.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for the granting authority, EU institutions, bodies, offices or agencies and national authorities to results for policy purposes — Horizon Europe actions

In Horizon Europe actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, EU institutions, bodies, offices or agencies for developing, implementing and monitoring EU policies or programmes. Such access rights do not extend to beneficiaries' background.

Such access rights are limited to non-commercial and non-competitive use.

For actions under the cluster ‘Civil Security for Society’, such access rights also extend to national authorities of EU Member States for developing, implementing and monitoring their policies or programmes in this area. In this case, access is subject to a bilateral agreement to define specific conditions ensuring that:

- the access rights will be used only for the intended purpose and
- appropriate confidentiality obligations are in place.

Moreover, the requesting national authority or EU institution, body, office or agency (including the granting authority) must inform all other national authorities of such a request.

Access rights for the granting authority, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy — Euratom actions

In Euratom actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy for developing, implementing and monitoring Euratom policies and programmes or for compliance with obligations assumed through international cooperation with non-EU countries and international organisations.

Such access rights include the right to authorise third parties to use the results in public procurement and the right to sub-license and are limited to non-commercial and non-competitive use.

Additional access rights

Where the call conditions impose additional access rights, the beneficiaries must comply with them.

COMMUNICATION, DISSEMINATION, OPEN SCIENCE AND VISIBILITY (— ARTICLE 17)

Dissemination

Dissemination of results

The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests.

Additional dissemination obligations

Where the call conditions impose additional dissemination obligations, the beneficiaries must also comply with those.

Open Science

Open science: open access to scientific publications

The beneficiaries must ensure open access to peer-reviewed scientific publications relating to their results. In particular, they must ensure that:

- at the latest at the time of publication, a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication, is deposited in a trusted repository for scientific publications
- immediate open access is provided to the deposited publication via the repository, under the latest available version of the Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights; for monographs and other long-text formats, the licence may exclude commercial uses and derivative works (e.g. CC BY-NC, CC BY-ND) and
- information is given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication.

Beneficiaries (or authors) must retain sufficient intellectual property rights to comply with the open access requirements.

Metadata of deposited publications must be open under a Creative Commons Public Domain Dedication (CC 0) or equivalent, in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: publication (author(s), title, date of publication, publication venue); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication.

Only publication fees in full open access venues for scientific publications are eligible for reimbursement.

Open science: research data management

The beneficiaries must manage the digital research data generated in the action ('data') responsibly, in line with the FAIR principles and by taking all of the following actions:

- establish a data management plan ('DMP') (and regularly update it)
- as soon as possible and within the deadlines set out in the DMP, deposit the data in a trusted repository; if required in the call conditions, this repository must be federated in the EOSC in compliance with EOSC requirements
- as soon as possible and within the deadlines set out in the DMP, ensure open access — via the repository — to the deposited data, under the latest available version of the Creative Commons Attribution International Public License (CC BY) or Creative Commons Public Domain Dedication (CC 0) or a licence/dedication with equivalent rights, following the principle 'as open as possible as closed as necessary', unless providing open access would in particular:
 - be against the beneficiary's legitimate interests, including regarding commercial exploitation, or

- be contrary to any other constraints, in particular the EU competitive interests or the beneficiary's obligations under this Agreement; if open access is not provided (to some or all data), this must be justified in the DMP
- provide information via the repository about any research output or any other tools and instruments needed to re-use or validate the data.

Metadata of deposited data must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s) and embargo); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for related publications and other research outputs.

Open science: additional practices

Where the call conditions impose additional obligations regarding open science practices, the beneficiaries must also comply with those.

Where the call conditions impose additional obligations regarding the validation of scientific publications, the beneficiaries must provide (digital or physical) access to data or other results needed for validation of the conclusions of scientific publications, to the extent that their legitimate interests or constraints are safeguarded (and unless they already provided (open) access at publication).

Where the call conditions impose additional open science obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) immediately deposit any research output in a trusted repository and provide open access to it under a CC BY licence, a Public Domain Dedication (CC 0) or equivalent. As an exception, if the access would be against the beneficiaries' legitimate interests, the beneficiaries must grant non-exclusive licenses — under fair and reasonable conditions — to legal entities that need the research output to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Plan for the exploitation and dissemination of results including communication activities

Unless excluded by the call conditions, the beneficiaries must provide and regularly update a plan for the exploitation and dissemination of results including communication activities.

SPECIFIC RULES FOR CARRYING OUT THE ACTION (— ARTICLE 18)

Implementation in case of restrictions due to strategic assets, interests, autonomy or security of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security, the beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless otherwise agreed with the granting authority.

The beneficiaries must moreover ensure that any cooperation with entities established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) does not affect the strategic assets, interests, autonomy or security of the EU and its Member States.

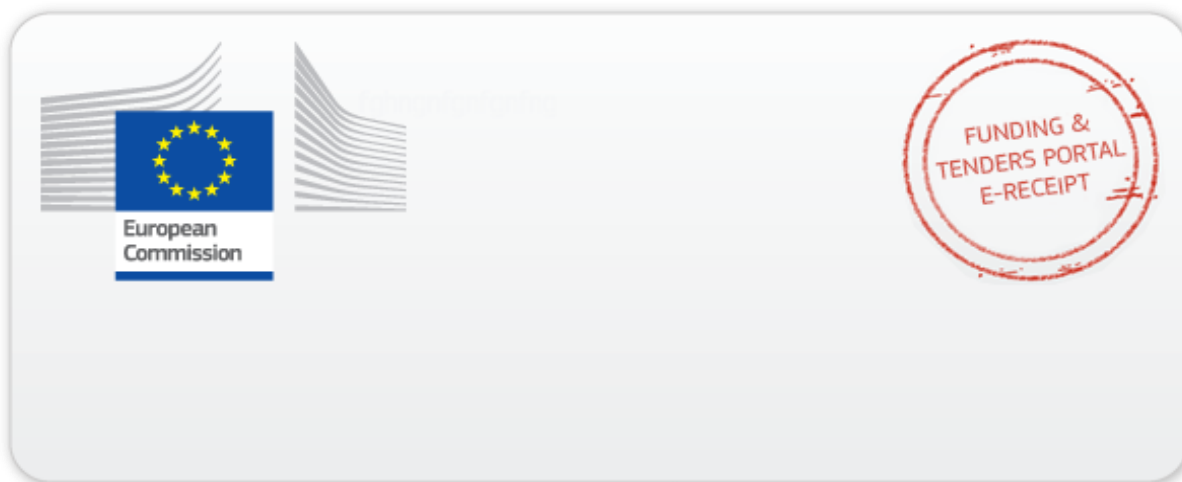
Recruitment and working conditions for researchers

The beneficiaries must take all measures to implement the principles set out in Annex II to the Council Recommendation on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe³ ('the European Charter for Researchers'), in particular regarding:

- working conditions
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and all participants involved in the action are aware of them.

³ Council Recommendation C/2023/1640 of 18 December 2023 on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe, Annex II (OJ C, C/2023/1640, 29.12.2023).



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