RADIUS

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1 Executive Summary

This document represents the Dissemination and Communication Plan ("DCP") of the RADIUS project defines the project dissemination and communication strategy and its implementation plan to be used by the consortium to ensure the high visibility, accessibility and promotion of the project and its results during the grant period. This DCP will be a reference framework for evaluating the impact of dissemination and communication activities and will be updated and adjusted as the project progresses.

To achieve the highest possible impact of its activities RADIUS will use and focus on maximising the effectiveness and scope of its dissemination and communication activities. These specific activities will not only address the general public to raise awareness on the project and its achievements, but also target key stakeholders having a relevant role in the field of activities undertaken by the project.

The Dissemination and Communication Plan (DCP) has been structured in various sections presenting the dissemination and communication objectives, players, roadmap, target audiences, main messages, and implementation measures.

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3 Abbreviations and Acronyms

Abbreviation/Acronym	Description
AB	Advisory Board
ACARE	Advisory Council for Aviation Research and Innovation in Europe
ADIF	Administrador de Infraestructuras Ferroviarias
ASECAP	European Association of Operators of Toll Road Infrastructures
BVLOS	Beyond Visual Line of Sight
EASA	European Union Aviation Safety Agency
EFRTC	European Federation of Railway Trackworks Contractors
EGNOS	European Geostationary Navigation Overlay Service
EGNSS	European Global Navigation Satellite Systems
EPC	Ethics and Privacy Controller
ERA	European Railway Agency
ERRAC	European Rail Research Advisory Council
ERTRAC	European Road Transport Research Advisory Council
ETF	European Transport Workers Federation
EUSCG	European UAS Standards Coordination Group
FGC	Ferrocarrils de la Generalitat de Catalunya
GA	Grant Agreement
GIE	Gas Infrastructure Europe
GSA	European Global navigation Satellite system Agency
IAMS	Intelligent Asset Management System
ICAO	International Civil Aviation Organisation
ICT	Information and Communications Technology
ID	IDentification
IEEE	Institute of Electrical and Electronics Engineers
IGB	Innovation Governance Board
IM	Innovation Manager
IPR	Intellectual Property Rights
JARUS	Joint Authorities for the Rulemaking of Unmanned Systems
PC	Project Coordinator
RADIUS	RAilway DIgitalization Using DroneS
RFI	Rete Ferroviaria Italiana
TMB	Technical Management Board
TMS	Traffic Management System
TRL	Technology Readiness Level
UAV	Unmanned Aerial Vehicle
UIC	International Union of Railways
UITP	International Association of Public Transport
UNIFE	Union of the European Railway Industries

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4 Introduction

4.1 RADIUS Objectives

The objective of the RADIUS proposal is to develop a drone-based technology (a) to monitor the physical status and electronic functionality of both non-safety-critical and safety-critical railway signalling assets and (b) to execute specific maintenance activities to pave the road to efficient and reliable unmanned activities.

RADIUS will focus on:

- Identification of the best drone technologies to be used in the railway sector, considering mainly the signalling assets to be monitored (from visual inspection to execution of measurements), the characteristics of the lines (segments, orography, tunnels, obstacles etc.), the maintenance actions to be implemented and the distances to be covered;
- Design of the drone solution capabilities and related payloads to integrate:
    - Sensors to enable data collection and processing capabilities to allow condition monitoring of signalling assets;
    - Wireless technology for establishing secure communication channels between the drone and the communication nodes of the peripheral post under observation, and to allow contact-less diagnostic and SW maintenance/update;
    - EGNSS-based solutions for navigation and positioning such as EGNOS (SBAS) and GALILEO capable to provide accurate and safe navigation positioning, enabling improved drones' flight control and safe movements in complex railways operational scenario;
    - Data transmission solutions to guarantee efficient, reliable and secure data exchange between drones and ground control infrastructure;
    - Data analytics (split between the on-board payload and the ground segment to optimise performances) aiming at a “real time intelligence” to perform assets monitoring, maintenance prediction analysis, and repairing actions reducing, and possibly eliminating, the need for railway track possession.
- The adaptation/redesign of railway signalling assets for drone-friendly maintenance activities. This includes the analysis of the subparts with:
    a) Highest failure rates mostly affected by low Mean Time Between Faults (MTBF) to allow the definition of the new design requirements and maximize the effectiveness and efficiency of inspection and maintenance using drones, and
    b) Highest frequencies of maintenance/tuning/re-calibration actions to define, develop, and validate “efficient maintenance” actions that can be carried out by drones.

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It will also include the design of a docking station for the drone in order to increase coupling between drones and signalling assets for both maintenance actions execution and recharging of the drone to increase its mission time;

- Interaction with existing Intelligent Asset Management Systems (IAMS) to:
  - guarantee a seamless integration of RADIUS results in current railway maintenance operations;
  - optimise processing power needs in the RADIUS system (both embedded in the drone and in the ground station) by exploiting the off-line processing power of IAMS;
  - contribute to the railway digitisation process;
- Interaction with current Traffic Management Systems (TMS) to improve the safe movements of drones within the railway;
- Planning of Beyond Visual Line of Sight (BVLOS) drone mission strategies compliant with aviation and railway regulations as well as with the complexity and the peculiarities of the railway environment;

Practical demonstration of the proposed solution into a prototype (TRL 6) in a railway relevant environment.

4.2 Scope of the DCP

This Dissemination and Communication Plan (DCP) implements the project dissemination and communication requirements contained in the RADIUS Grant Agreement, and follows the recommendations included on the document “Communicating EU research and innovation guidance for project participants”.

The structure of the documents is as follows:

- First, the document establishes the contractual obligations and requirements regarding the project’s dissemination and communication activities and describes the dissemination and communication objectives and strategy.
- This is followed by a concrete and unique brand identity designed to make the project recognisable and give it its own identity. To ensure that all partners know how to integrate the brand identity into the different communication platforms and printed materials, the deliverable includes a simple brand manual section.
- The deliverable identifies the high-level messages to be delivered, the target audiences identified and the channels to be used to engage the target audiences and lists the dissemination and communication activities that are planned throughout the project duration.
- Finally, specific key performance indicators (KPIs) have been established to measure the dissemination and communication efforts.

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This document is focused on dissemination and communication activities. A more detailed document regarding Exploitation activities (D9.2) will be delivered separately.

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5 Dissemination and communication requirements

5.1 Requirements in the Grant Agreement

The main requirements concerning dissemination and communication activities are contained in Articles 29.1, 29.4, 29.5, 38.1.1 and 38.1.2 of the Grant Agreement (GA).

With respect to the obligation to disseminate the results of the project, article 29.1 states:

> ***29.1 Obligation to disseminate results***
>
> *Unless it goes against their legitimate interests, each beneficiary must — as soon as possible —* ***'disseminate' its results by disclosing them to the public by appropriate means (other than those*** *resulting from protecting or exploiting the results), including in scientific publications (in any medium) ...*

The disclosure of the funding received by the GSA is covered in articles 29.4 and 38.1.2 state, with a very similar wording, the following requirements.

> ***29.4 Information on Agency funding — Obligation and right to use the Agency logo and the EU emblem***
>
> *Unless the Agency requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:*
>
> *(a) display the Agency logo and*
>
> *(b) display the EU emblem and*
>
> *(c) include the following text:*
>
> *"**This project has received funding from the European GNSS Agency under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004192**".*
>
> *When displayed together with another logo, the Agency logo and the EU emblem must have appropriate prominence.*
>
> *For the purposes of their obligations under this Article, the beneficiaries may use the Agency logo and the EU emblem without first obtaining approval from the Agency.*
>
> *This does not however give them the right to exclusive use.*
>
> *Moreover, they may not appropriate the Agency logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.*

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Article 29.5 requires any dissemination document to explicitly include a disclaimer:

> ***29.5 Disclaimer excluding Agency responsibility***
>
> *Any dissemination of results must indicate that it reflects only the author's view and that the Agency is not responsible for any use that may be made of the information it contains*

The obligations related to communication activities are covered in article 38.1.1, which states:

> ***38.1.1 Obligation to promote the action and its results***
>
> *The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.*
>
> *This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.*
>
> *Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the Agency (see Article 52).*

5.2 Requirements for external communications made by the partners

To ensure that all requirements described in 5.1 are adequately fulfilled, any communication activity shall be in accordance with the specific additional requirements of the Data Management Plan, as defined in the RADIUS deliverable D1.2.

In particular, any mention to the GSA that could be construed as the GSA endorsing the results of the project has to be agreed upon with the GSA and all the presentations and materials produced for external events or conferences, have to be approved before using them by the Project Coordinator (PC) and the Dissemination Leader (DS).

5.3 Dissemination and Communication guidelines

In summary, to comply with the requirements described above, dissemination and communication activities of the project should adhere to the guidelines established below:

1. All external communication activities, including the dissemination of results, will be coordinated internally with the PC and the DS.
2. Any communication or dissemination of results must indicate that it reflects only the author’s view and that the GSA is not responsible for any use that may be made of the information it contains.
3. All external communication material should include the following elements:
    a. EU Emblem
    b. European GNSS Agency Logo

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c. Contain a reference to the grant funding from Horizon 2020, i.e.: "*This project has received funding from the European GNSS Agency under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004192*"

When used in combination with other logos, the EU Emblem and GSA logos should be given enough prominence.

An example of use of these three elements is shown below:

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6 Dissemination and communication objectives and strategy

6.1 Promotion of the RADIUS concept

The RADIUS concept constitutes a novel approach to maintaining the railway infrastructure.

The RADIUS approach will therefore not only facilitate maintenance operations of railway tracks, but will also open the door to the integration of drones to perform other complex operations on the railway domain in coordination with the TMS and not interfering with the normal operations of the railway lines.

For this reason, the RADIUS consortium will place an emphasis on the communication, dissemination and exploitation activities that are described in this document with a view to promoting the RADIUS concept and presenting its advantages to the railway sector.

These activities will focus on:

- description of the limitations of the current methods,
- description of the RADIUS approach,
- presentation of the advantages that will be provided by the service.

6.2 Specific objectives of the RADIUS project

The specific objectives of the dissemination and communication activities are:

- Generate the greatest possible impact of the project objectives and results on the railway domain as well as on the society as a whole.
- Ensure that the results of the project provide a solid basis to continue working in the future to develop the RADIUS concept.

6.3 General objectives of HORIZON 2020 projects

In addition, RADIUS will support the general objectives established by the H2020 dissemination and communication guidelines:

- Show how **European collaboration achieves more than would have otherwise been possible**, notably in achieving scientific excellence, contributing to competitiveness, and solving societal challenges.
- Show **how the outcomes are relevant to our everyday lives**, by creating jobs, introducing novel technologies, or making our lives more comfortable in other ways.
- **Make better use of the results**, by ensuring that they are taken up by decision-makers.

6.4 Dissemination and communication strategy

RADIUS will implement a streamlined dissemination and communication strategy including the planning and implementation of communication activities. The definition of the communications action plan contained in

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this document sets the basis for ensuring that the project consortium will agree on the overall mission for communications, key audiences/stakeholders, key-communication programs/activities, messages targeting individual audience/stakeholder, a key measure of effectiveness, roles and responsibilities for communication. The communication plan will be designed considering the key audiences and their current know-how concerning RADIUS relevant topics, what do they have to know for an effective understanding of the RADIUS key messages, what are the messages to be delivered to individual targets, what are the most effective media to deliver these messages.

The **key contents** within the planned communication strategy are outlined as follows:

[1] Definition of key messages: The key messages to spread are directly connected to the impact and expected results and will sustain the joint exploitation activity (see section 8.1).
[2] Establish diverse modes of communication channels and their alignment with each target audience (see sections 8.3 and 8.4).
[3] Build relationship with different media-oriented groups: Define a target list and a strategy on how to involve opinion leaders, journalists, associations, etc., and the most suitable strategy for the dissemination of the RADIUS activities and results. This includes contributing to topic focused blogs, social groups and other Internet only active communities (see section 8.4).
[4] Cross fertilisation through the liaison with the most important initiatives that are relevant to the objectives of RADIUS (see chapter 10).

6.5 Dissemination and communication individual strategies

The dissemination leader EUSC will oversee the overall monitoring of the communication and dissemination activities and the creation and management of the Advisory Board (AB).

The other RADIUS partners are key actors for the communication and dissemination activities, being able to reach most of the identified target audiences.

Partner	Links
STS	STS, as leading company in the railway signalling sector, will disseminate its results in the main railway-specific fairs and events. Moreover, STS will publish scientific results in the railway specific conferences and journals. STS, through its participation to the Shift2Rail initiative as founding member and its UNIFE membership can reach all the main railway industries.
EVO	EVOLEO as a SME will promote the results of the project with exploitation in mind. It will participate in tradeshows like InnoTrans, RailTech and others. It will disseminate to EVOLEO contact networks on social media, webpage and mailing lists.
ZB	ZB, as spin-off of the Univ. of Genova, will use all available academic dissemination channels to disseminate RADIUS results. The plans are to publish results into peer-reviewed journals and conferences with focus on those related to Machine Learning, Learning Analytics and AI.
AEO	AERORUM will promote the project through the company´s digital channels and to disseminate the project to end users within the AEORUM contact network at European level. Planned Activities: B2B meetings with end-users, presentation and attendance at industry events

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EUSC	EUSC is leading the dissemination strategy and will present the results of the RADIUS project in drone-related conferences such as UAS CivOps, UAV Expo. Moreover, EUSC will exploit its network of drone professionals to spread the information about RADIUS results
IP	IP plans to promote the project through the company´s digital channels and to disseminate the project to relevant stakeholders. IP, being member of UIC, can reach more than 200 Infrastructure Managers.

Table 1 – RADIUS Partners individual dissemination strategies

6.6 Dissemination and communication deliverables

The following table shows the list of deliverables related with the dissemination and communication activities.

#	Deliverable title	Lead beneficiary	Type	Dissemination level	Due date
D9.1	Dissemination and communication plan	EUSC	Report	Public	Jun 2021
D9.2	Exploitation Plans	EUSC	Report	Confidential	Dec 2023
D9.3	Dissemination results	EUSC	Report	Public	Dec 2023

Table 2 – Dissemination and communication deliverables

6.7 RADIUS Advisory Board

The project management structure foresees an international Advisory Board (AB) that will advise the project to ensure its results address the real needs of the railway community.

The AB is invited to share the lesson learned within the project, to provide recommendations and best practices, and feedback on the outcomes of the project.

The AB will meet at least once per year, preferably in person. During the Covid-19 emergency, meetings will take place as teleconferences.

The bodies shown in the following table have already accepted to be part of the Advisory Board.

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Organisation	Type of organisation
FGC	Infrastructure Manager & Operator
UIC	Railway Association
EUROCONTROL	International Organisation
MBDA	Private company
RFI	R&D Department
University of Naples Federico II	Academia
Scuola Superiore Sant'Anna	Academia
DB Netz	Infrastructure Manager
ADIF	Infrastructure Manager

Table 3 - RADIUS Advisory Boar

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7 Graphical identity guidelines

7.1 Project logo

The logo to be used to identify the project is shown in Figure 1.

Figure 1 – Project RADIUS main logo

The following alternatives can be used when it is not possible to use the RADIUS colours or when using the logo inside a dark background.

Figure 2 – Grayscale logo alternative

Figure 3 – White logo alternative for dark backgrounds

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7.2 Colour schemes

The following colour scheme should be used when possible:

Main colour

C: 85% M: 68% Y: 33% K: 13%
R: 68 G: 85 B: 121
HTML hex code: # 445579

Primary Accent colour

C: 0% M: 47% Y: 100% K: 0%
R: 231 G: 152 B: 36
HTML hex code: # E79824

Accent colour 2

C: 19% M: 11% Y: 2% K: 0%
R: 202 G: 212 B: 231
HTML hex code: # CAD4E7

Accent colour 3

C: 95% M: 80% Y: 45% K: 44%
R: 35 G: 50 B: 74
HTML hex code: # 23324A

Colour for text

C: 68% M: 64% Y: 63% K: 58%
R: 40 G: 40 B: 40
HTML hex code: # 282828

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8 Messages, targets, and channels

8.1 Project Motto

The one-phrase motto of the project is:

Welcome to the future of railway signalling asset monitoring and maintenance using drones

8.2 Project High Level Messages

Effective communication should be simple and relevant to the recipient of the message. A common approach to convey effective communication is shown on the following diagram.

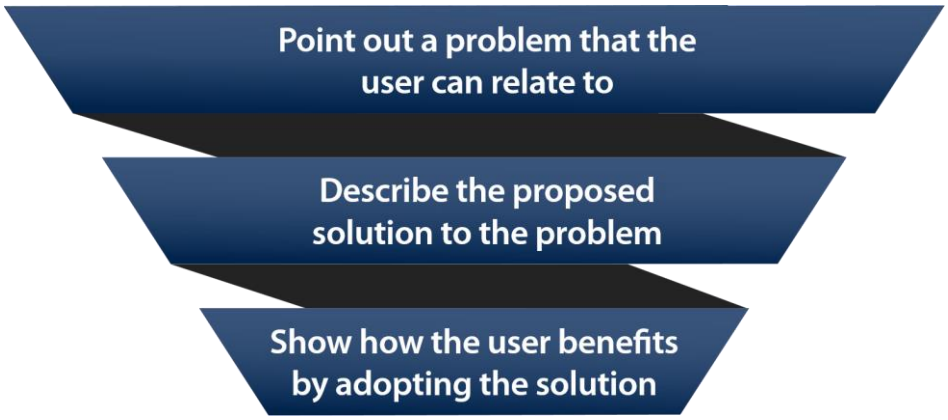

Figure 4 – Effective communication pipeline

First, the recipient of the message has to understand the problem and acknowledge that the problem affects him. Then, the recipient should be able to understand the proposed solution. Finally, the users should see the potential benefits provided by the proposed solution.

For that reason, all dissemination and communication activities carried out during the project should employ follow the pattern described which is articulated through the following three high-level messages:

Identification of the problem

The railway maintenance problem

There is currently no optimal solution to inspect, monitor and maintain railway signalling assets. Human inspection activities are highly demanding in terms of costs and operational constraints (tracks being inspected have to be closed or limited) and impose safety concerns. Wired solutions are very expensive and prone to failures. Cables have to be maintained, increasing the maintenance burden. Limited bandwidth of the solution implies that only a limited number of features can be monitored. Diagnostic trains run at lower speed than commercial trains impacting track capacity. Trains and their monitoring equipment are complex equipment that require high investments and operational costs

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Description of the solution

The RADIUS approach

RADIUS will design, develop, test and demonstrate a complete monitoring and maintenance system using unmanned aerial systems (UAS). The solution will include the design of the UAS including the sensors and an enhanced positioning and navigation system, the adaptation or redesign of signalling assets including the design of a docking station and full interaction with the Intelligent Asset Management Systems (IAMS) and the Traffic Management System (TMS). The project will conduct an extensive practical demo after performing an aviation Safety Risk Assessment and ensuring full compliance with all applicable railway and aviation regulations

Main benefits

RADIUS benefits

RADIUS will increase the frequency of inspections resulting in the implementation of preventive measures that will increase the life span of signalling assets. The system will be easier to use and will reduce the initial cost and the running costs required to maintain railway infrastructures. RADIUS will increase the safety of the maintenance operations and the overall operational safety of the railways. Finally, the RADIUS approach can be extended to other activities and markets, creating new service provision business models for the railway sector and beyond.

8.3 Target Audience Identification

Dissemination and communication activities will be geared towards eight different stakeholder target groups that are listed on the following table. For each target group we have already identify candidate organisations to be contacted and the main communication and dissemination objectives for each target.

Target group	Candidate organisations	Objectives
Railway infrastructure managers and train operators	All UIC members, RailNetEurope members, International Association of Public Transport (UITP)	Promote the RADIUS results and find end-users for RADIUS follow-ups
Scientific communities	Scientific stakeholders in the railway, UAS and ICT sectors	Disseminate RADIUS scientific innovations
National, EU and international authorities	European Railway Agency (ERA), European Union Aviation Safety Agency (EASA), International Civil Aviation Organisation (ICAO), Joint Authorities for the Rulemaking of Unmanned Systems (JARUS), European UAS Standards Coordination Group (EUSCG), EUROCONTROL, etc	Influence decision making, regulations and standards
Transport European Technology Platforms (ETPs)	European Road Transport Research Advisory Council (ERTRAC), Advisory Council for Aviation Research and	Disseminate and promote the RADIUS concept for monitoring and maintenance of critical infrastructures and other linear

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	Innovation in Europe (ACARE), European Rail Research Advisory Council (ERRAC)	transport modes such as motorway and inland waterways. Identify partnership for industrialisation and technological improvement
Industrial Transport Associations	Union of the European Railway Industries (UNIFE), European Transport Workers Federation (ETF), European Federation of Railway Trackworks Contractors (EFRTC)	
UAS manufacturers associations	National and international UAS trade associations	
General public		Communicate how technology can improve health and safety in working environments
Representatives of other industrial sectors	European Association of Operators of Toll Road Infrastructures (ASECAP), Gas Infrastructure Europe (GIE), etc	Identify other possible exploitation channels

Table 4 – Target dissemination and communication groups

8.4 Dissemination and communication channels

Figure 5 shows the segmentation of the identified target groups in terms of their technical and scientific knowledge and their personal interest in the outcome of the project (or in other words, their relation to the project):

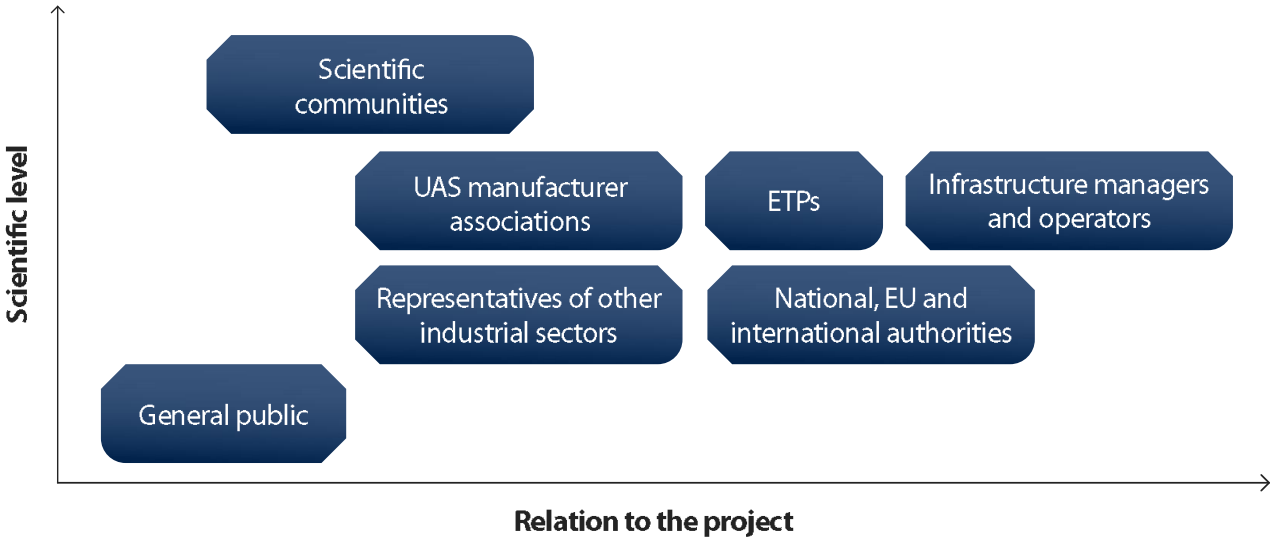

Figure 5 - Target audience segmentation

Due to the dispersion of scientific level and involvement with the project, different messages and means to deliver them will be employed to reach and convey the messages in the most effective way to the different target audience segments defined above.

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The main communication channel will be the project website, which will include a public area containing a description of the consortium, the objectives of the project and a number of assets to be used by interested parties or members of the press as described below. It will also provide a means of contact with the members of the RADIUS consortium to obtain more information or to collaborate with the consortium during the duration of the project. The website will also include a private section with access limited to members of the consortium, the GSA and members of the AB. The website will be linked to by the websites of consortium members and will link to and be linked to by the GSA website.

The project website will also be the online repository for all open-access scientific data generated during the project.

The project's presence on social media platforms will include use of **YouTube, LinkedIn and Twitter** as a means of extending the reach of the project and its activities.

As mentioned above, a number of supporting documents will be employed to stimulate awareness of the RADIUS project in a unified and attractive way. This will include press releases, project leaflets, presentations, videos and newsletters. These tools will be constantly updated to reflect the project's progress, achievements, and intermediate and final results.

Publication in specialised magazines will be key for the wide dissemination of project results and for EU society.

- **Railway-specific journals**, such as International Railway Journal, Rail Magazine
- **Drone-specific journals**, such as Journal of Unmanned Aerial Systems, Elsevier Aerospace Science and Technology, Int. Journal of Intelligent Unmanned Systems, etc.
- **ICT journals**, such as IEEE Spectrum, IEEE Internet of Things Magazine, IEEE Trans. on Pattern Analysis and Machine Intelligence, etc.

RADIUS results will be disseminated at national and international level through participation in **conferences and other public events**. Participation will be at different levels, including presentations, workshops, and panels. The following conferences and public events will be considered for participation and monitored to check how and when will be restarted.

Domain	Conferences and Public Events
Rail	Transport Research Arena
	World Congress of Railway Research
	International Railway Congress
	InnoTrans
	International Conference on Railway Technology
Drone	European Drone Summit
	Commercial UAV Expo

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	UNVEX
	UAV Technology
	International Conference in UAS Technology
ICT	IEEE Workshops such as “IEEE Workshop on "Integrating UAVs into 5G and beyond” and IEEE Int. Symposium on Safety, Security, and Rescue Robotics (SSRR)

Table 5 – Events and Conferences

RADIUS will organise an **intermediate workshop and a final event** at UIC premises to promote and disseminate project’s results to the railway stakeholders

8.5 Dissemination and communication planned activities

The following Table 6 lists a selection of some relevant dissemination and communication activities currently foreseen during the first year of the project. The table will be updated when the uncertainties regarding the current Covid-19 induced situation is clarified.

Title	Activity type	Date
Publication of the RADIUS Project on the consortium members’ websites	Online	Jan-Jun 2021
Submission of a paper for the WCRR conference	Event	May 2021
First advisory board meeting	Advisory Board	July 2021

Table 6 – Schedule of dissemination and communication activities

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9 Main dissemination and communication tools

To support the dissemination and communication activities, the following supporting elements have been created:

- Website
- Social media channels
- Brochure

In addition, the following tools and assets will be developed:

[1] A short video (2-3 minutes maximum)

[2] It is foreseen that a minimum of three public white papers will be produced during the project. These white papers, summarising the main findings of the project, will be written in a non-technical manner suitable for all audiences.

9.1 Website

The website is the main element for supporting the dissemination and communication effort, as well as the repository of all the documentation generated by the project.

The website has a public interface that is accessible to everybody and a private Member Area section that is only accessible to registered users, such as the members of the consortium, members of the Advisory Board, and SJU personnel.

9.1.1 Website structure

Each page of the website is organised into three different sections:

Navigation bar

Figure 6 – Navigation bar

At the top of every page there is a navigation bar that provides access to the different pages available.

The navigation bar will also provide access to the login page in the future, necessary for accessing the private section of the website.

Main content

The main content section varies on each page according to the specific topic covered.

Footer

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The footer includes a prominent subscribe section, links to the social channels, a selection of last news published, as the funding and copyright and privacy notices.

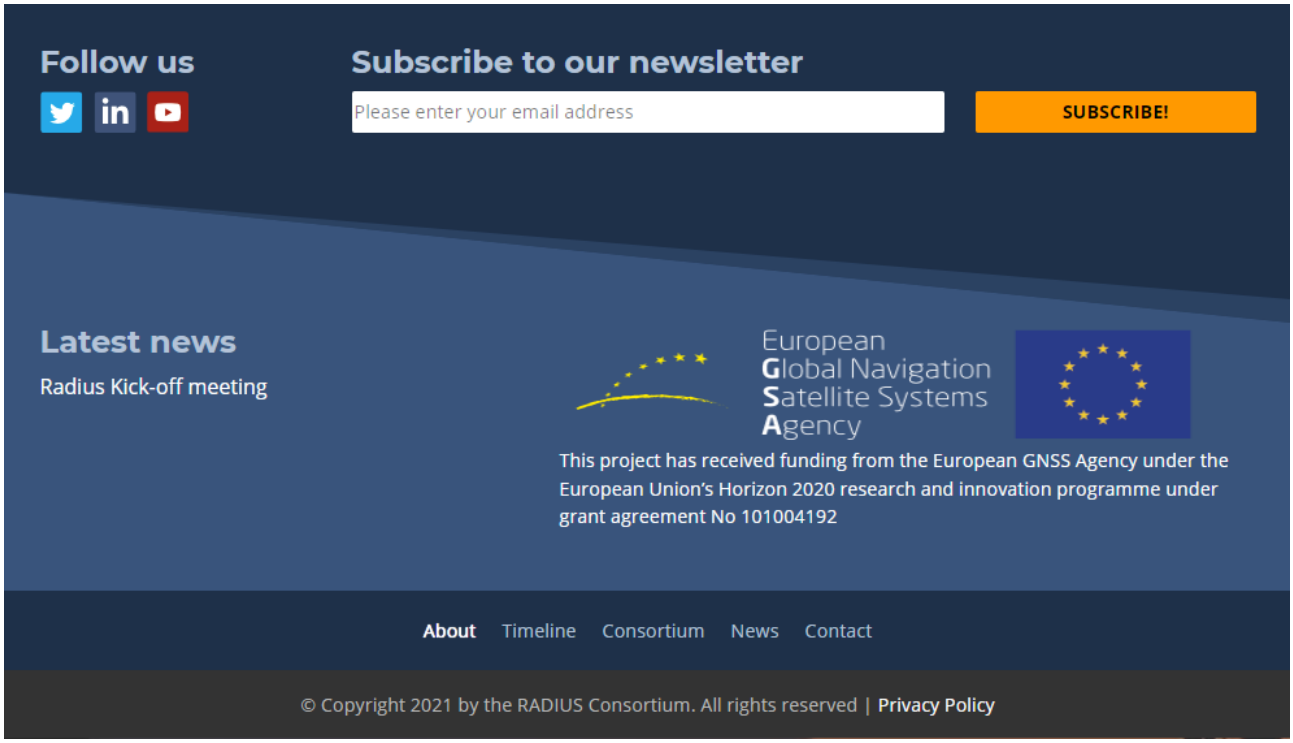

Figure 7 – Footer section

9.1.2 Main page (About)

The main page contains the project motto and the three high-level messages. It is divided into various sections as shown below.

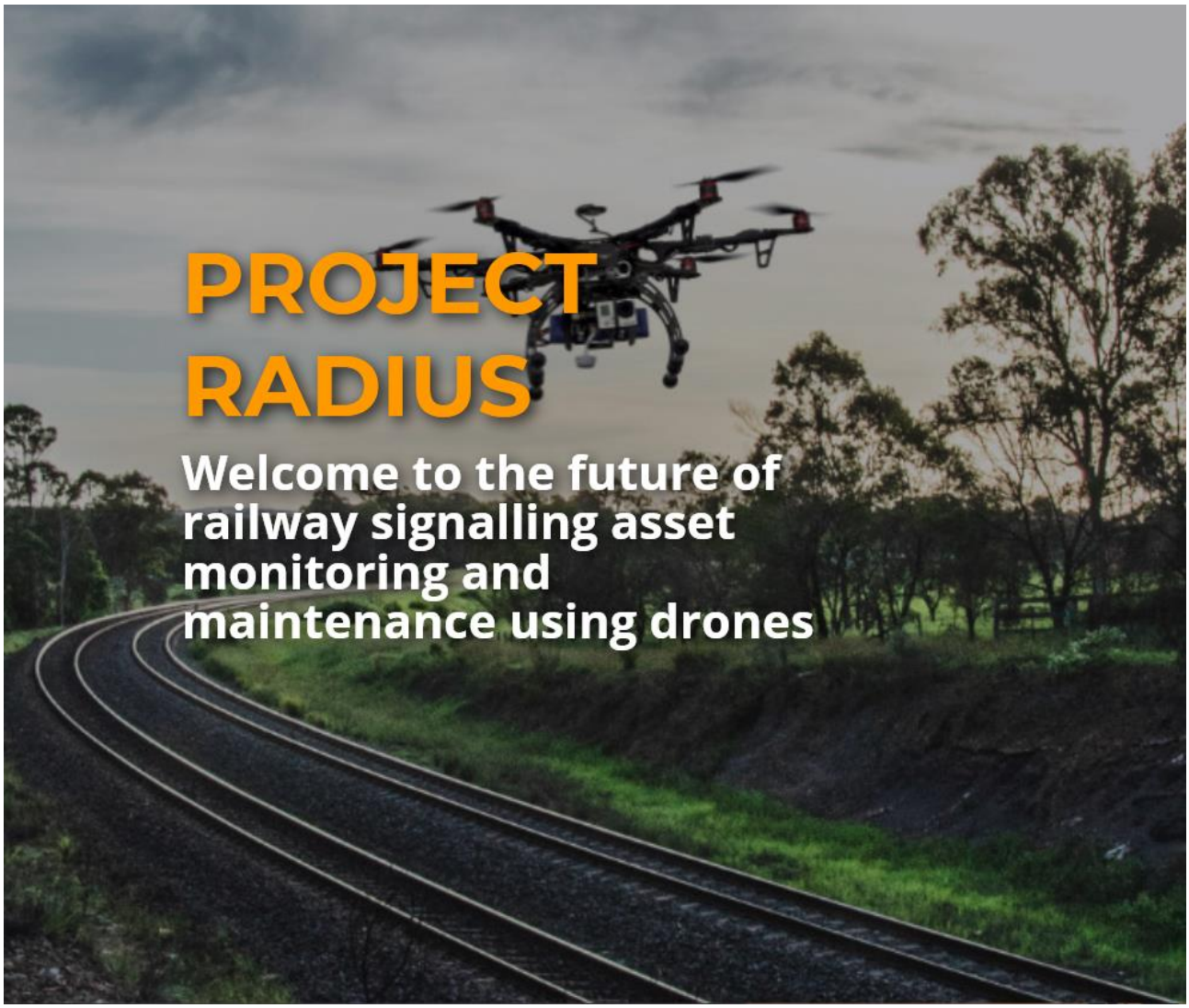

Figure 8 – Project Motto section

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Figure 9 – Railway maintenance challenge section (Description of the problem)

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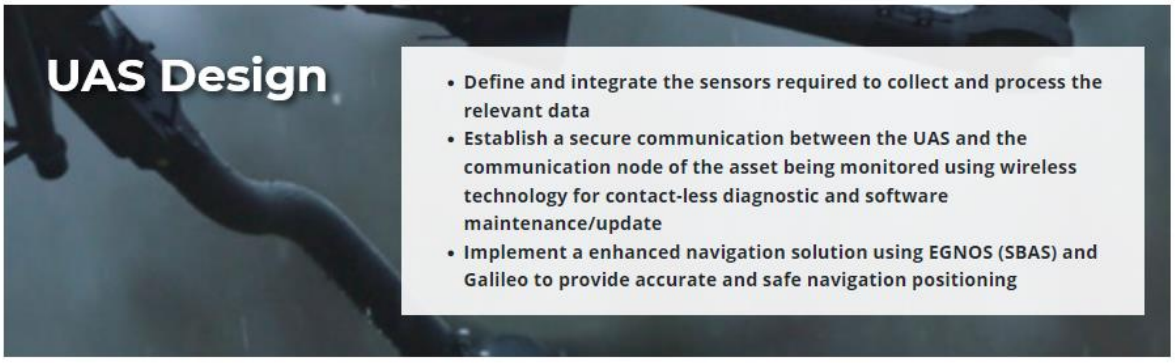
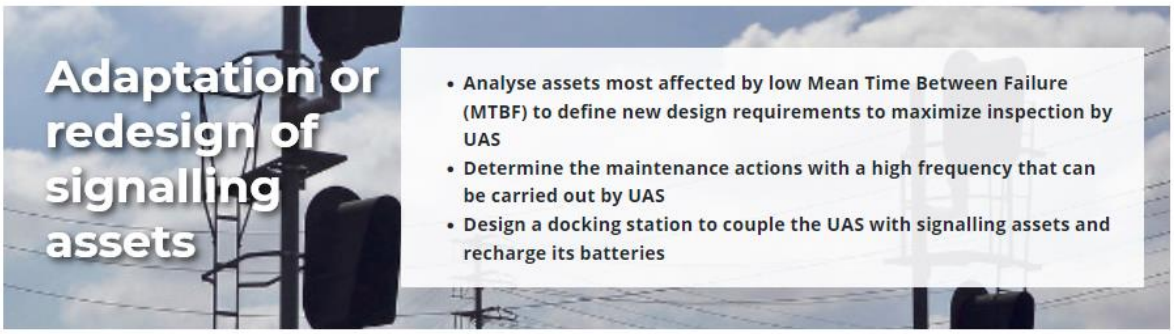
The RADIUS approach

RADIUS will design, develop, test and demonstrate a **complete monitoring and maintenance system** using unmanned aerial systems (**UAS**)





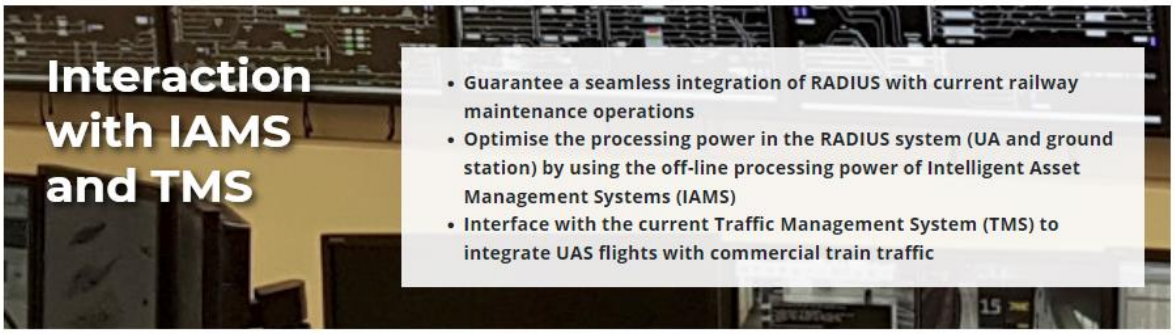


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Figure 10 – The RADIUS approach section (Description of the solution)

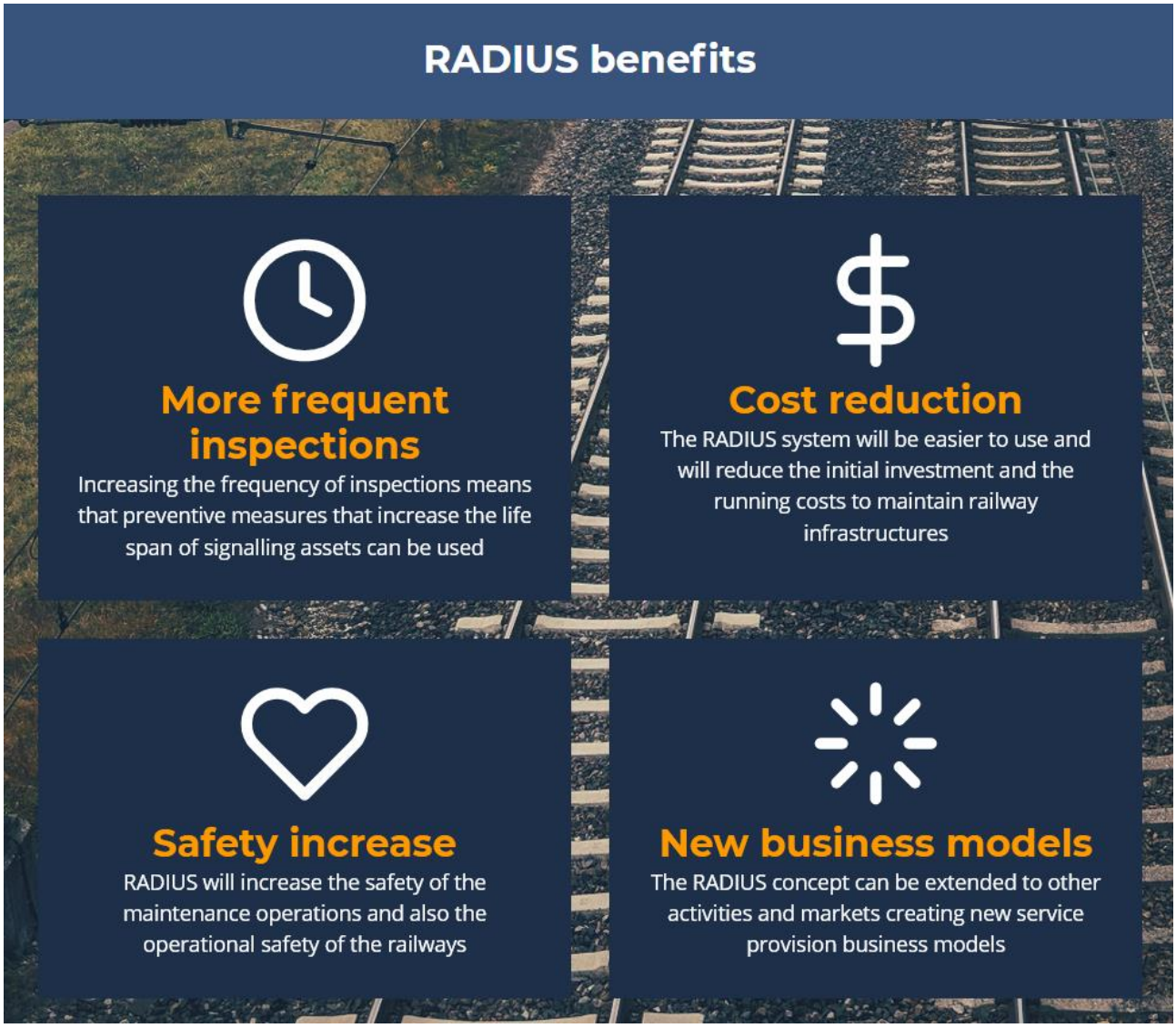

Figure 11 – Radius benefits section

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9.1.3 Consortium page

The consortium page provides a brief description of the consortium partners and their contact information.

RADIUS Consortium

Coordinator

Hitachi Rail STS

Hitachi Rail STS is a global leader in passenger rail systems, designing, building, operating and maintaining Railway and Mass Transit solutions that range from fully integrated turnkey solutions to traditional signaling systems.

All around the world Hitachi Rail STS is a full service provider creating and developing for its clients new and upgraded railway, Mass Transit, Freight Lines and Operation and Maintenance. From passenger to freight transportation networks, from urban to intercity and cross-border high speed lines, Hitachi Rail STS designs and deploys cutting-edge technologies to meet operators' needs and optimize performance independently of traffic density and complexity.

Partners

Aeorum España S.L.

Aeorum is a technology-based company founded in 2009 as a private spin off of the University of Malaga. The aim of the company is to offer technological and innovative solutions for a safer society. The value proposition of Aeorum, designed for security managers, consists of innovative tools for preventive surveillance that will help them to make quick and reliable decisions in order to manage and avoid emergency situations and, therefore, to reduce the risks associated with quick decision-making.

Thanks to our experience in EU co-funded projects, Aeorum has its own technologies, which allows us to offer a wide range of solutions that may be adapted to the security managers needs in different fields of action, such as: searching and locating people, protection of critical infrastructures, fire detection and extinguishing strategies, surveillance in urban environments, etc

In addition, Aeorum is very experienced in RAV technologies, in particular, adding artificial intelligence and computer vision capabilities for drone fleet management.

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EuroUSC España S.L.

EuroUSC España is an aviation safety consulting company, specialized in Unmanned Aerial Systems (UAS) and Remotely Piloted Aircraft Systems (RPAS). Our services cover the entire workflow of a successful UAS operation.

EuroUSC Italia s.r.l

EuroUSC Italia S.r.l. is a limited responsibility company (s.r.l.) established at the Chamber of Commerce in Rome, whose shareholders are Deep Blue s.r.l. (70%) and Prof. Filippo Tomasello (30%).

The combined capabilities of the company and its shareholders include more than four decades of involvement in military and civil aviation including at global level and in the domains of ATM/ANS, airspace design and management, aerodromes, flight testing, rulemaking as well as one decade of practical experience on drones, including airworthiness and qualification of remote pilot, safety assessment, human factors, validation of new concepts and related technologies for air traffic management.

EUSC-IT covers all domains relevant for the civil UAS industry or for drones flying under General Air Traffic

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Evoleo Technologies LDA

EVOLEO Technologies is a Portuguese SME investing in skills related to the design of critical and highly complex electronic systems. EVOLEO embraces five areas of activity: Space, Transportation, Energy, Health and Industry.

Our mission is to provide high-end and differentiated electronic engineering solutions, seeking continuous improvement, flexibility, quality and customer oriented innovation. We aim international recognition as a technological company for leveraging partnerships, added value enhancement and sustainable growth.

EVOLEO provides engineering services covering a wide range of needs in the electronics design, embedded and systems engineering. We search and promote partnerships and networking with centers of knowledge and industry players, in line with its mission of providing high-end and differentiated electronic engineering solutions, seeking continuous improvement, flexibility, quality and customer oriented innovation. We aim international recognition as a technological company for leveraging partnerships, added value enhancement and sustainable growth.

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Infraestruturas de Portugal, S.A.

Infraestruturas de Portugal is the public company that results from the merger between the Rede Ferroviária Nacional - REFER, E.P.E. (REFER, EPE) and EP - Estradas de Portugal, SA (EP, SA) through which REFER, EPE, incorporates, by merger, EP, SA, and is transformed into a public limited company, changing its name to Infraestruturas de Portugal, SA (IP, SA). The merger was established on June 1, 2015, following Decree-Law No. 91/2015 of May 29. In practice, road and railway infrastructures are now managed by a single company, according to a joint, integrated and complementary strategy.

IP, whose only shareholder is the Portuguese State, is subject to the supervision of the Ministries of Planning and Infrastructure and Finance.

ZenaByte s.r.l.

ZenaByte is an innovative start-up and a spin-off of the University of Genoa whose main objective is the "Development of innovative methodologies for intelligent management, interpretation and extraction of knowledge from data".

The ZenaByte core business is represented by the design, development and application of leading-edge Artificial Intelligence (AI) and Data Analytics approaches, solutions and tools to: Intelligent data management, processing, interpretation and reporting; Knowledge Extraction from data; Data enhancement to turn data into valued corporate assets; Decision support systems for modern industrial sectors and supply chains integrating predictive and prescriptive data analytics with risk analysis; Trustworthy AI; Guarantee availability, confidentiality and integrity of IT systems integrating currently available leading-edge technological solutions (e.g., blockchains).

Figure 12 – Consortium page

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9.1.4 Timeline page

The timeline page provides a visual representation of the progress of the project, listing its main development phases and its current status.

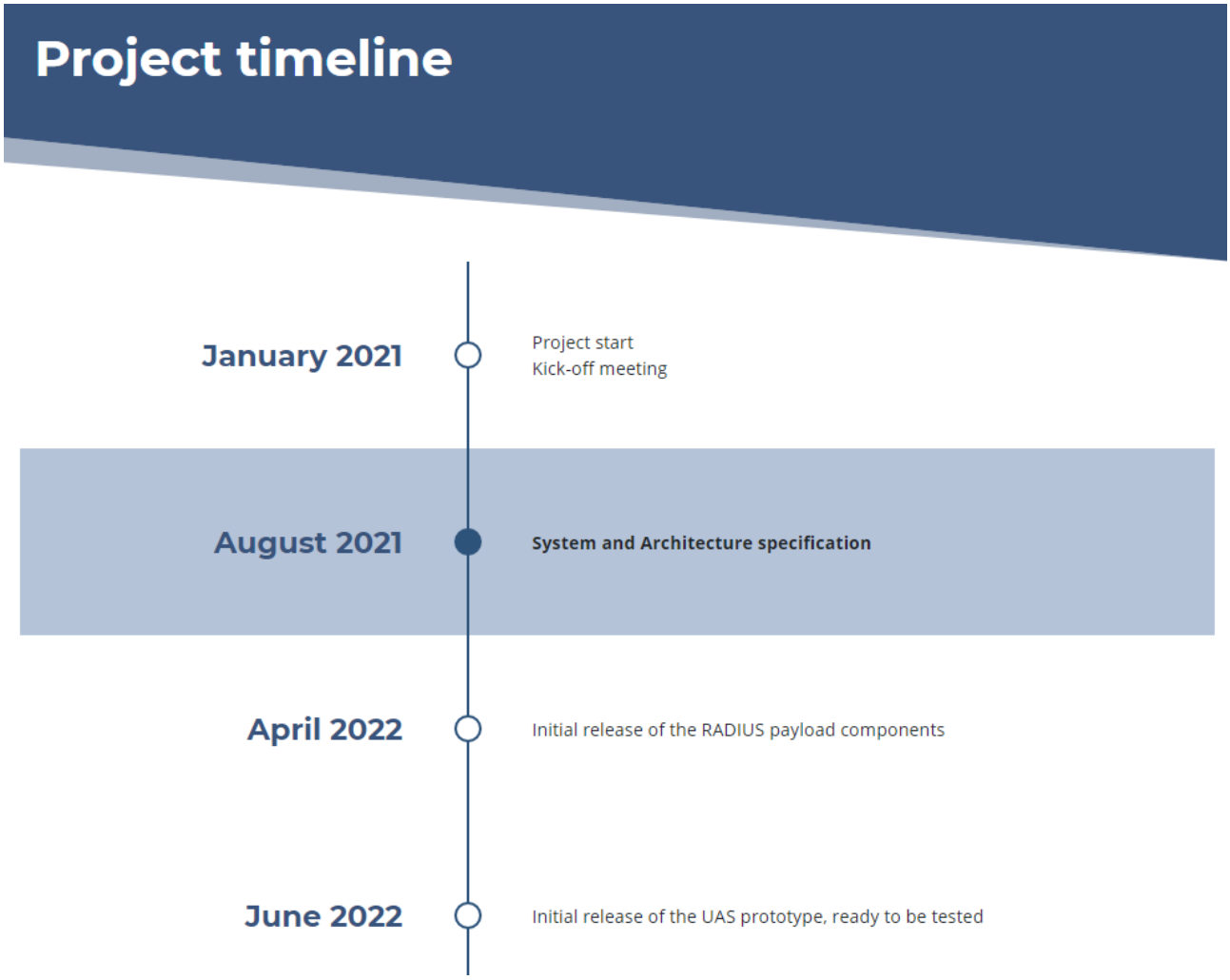

Figure 13 – Timeline page

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9.1.5 News page and news items

The news page is a repository of articles written to describe the project, its main findings, and notices of dissemination and communication actions such as conferences where RADIUS results will be presented.

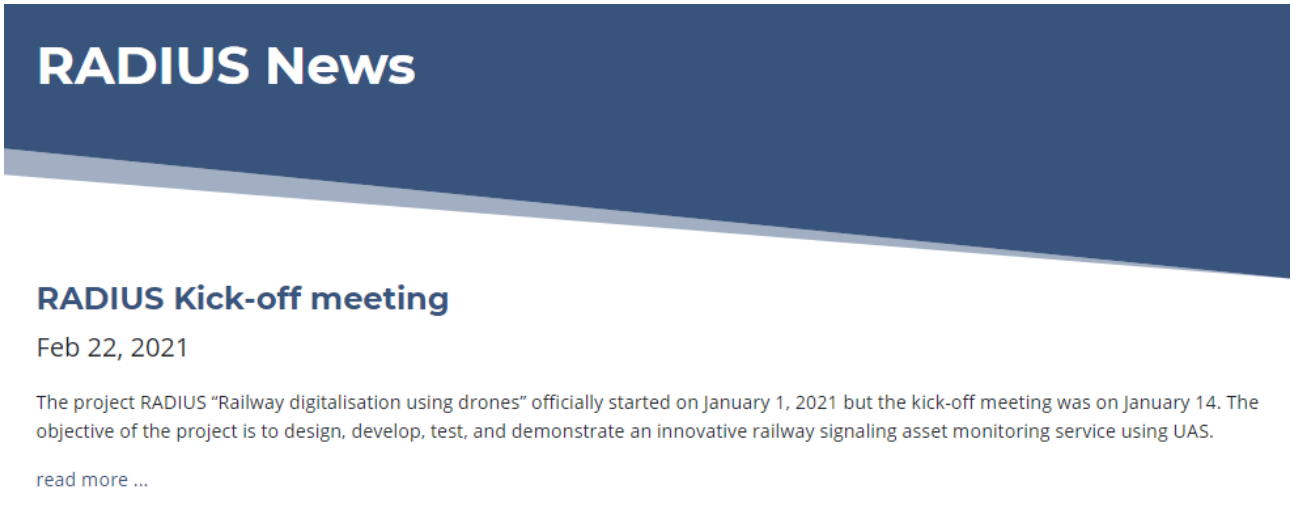

Figure 14 – News page

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RADIUS Kick-off meeting

Feb 22, 2021

On January 14, 2021 took place the Kick-Off Meeting that marks the official start of the "Railway digitalisation using drones" or RADIUS Project, a 36-month Innovation Action that aims to develop and test the use of Unmanned Aerial Systems (UAS) to monitor and maintain railway signalling assets. The project has been awarded a grant under the 'EGNSS applications fostering digitisation' call (DT-SPACE-EGNSS-2-2019-2020), whose specific challenge is to promote the adoption of EGNSS and Galileo in mass markets, ensuring that users take advantage of the features and benefits provided by these European programmes.

The main objectives of RADIUS are to design the unmanned system that will be used, select the categories of assets to be monitored and the maintenance actions to be performed, integrate the RADIUS system into the current maintenance operations, taking advantage of the processing power of the existing Intelligent Asset Management Systems, interface with the Traffic Management System to reduce the impact of the system in the railway operations.

The project includes a planned demonstration of the developed prototype in a railway relevant environment, thus achieving a Technology Readiness Level (TRL) of 6, after completing an aviation risk assessment and a regulatory compliance analysis.

Figure 15 – Sample news post

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9.1.6 Contact page

The contact page provides the best way to contact the RADIUS Team to get more information about the Project.

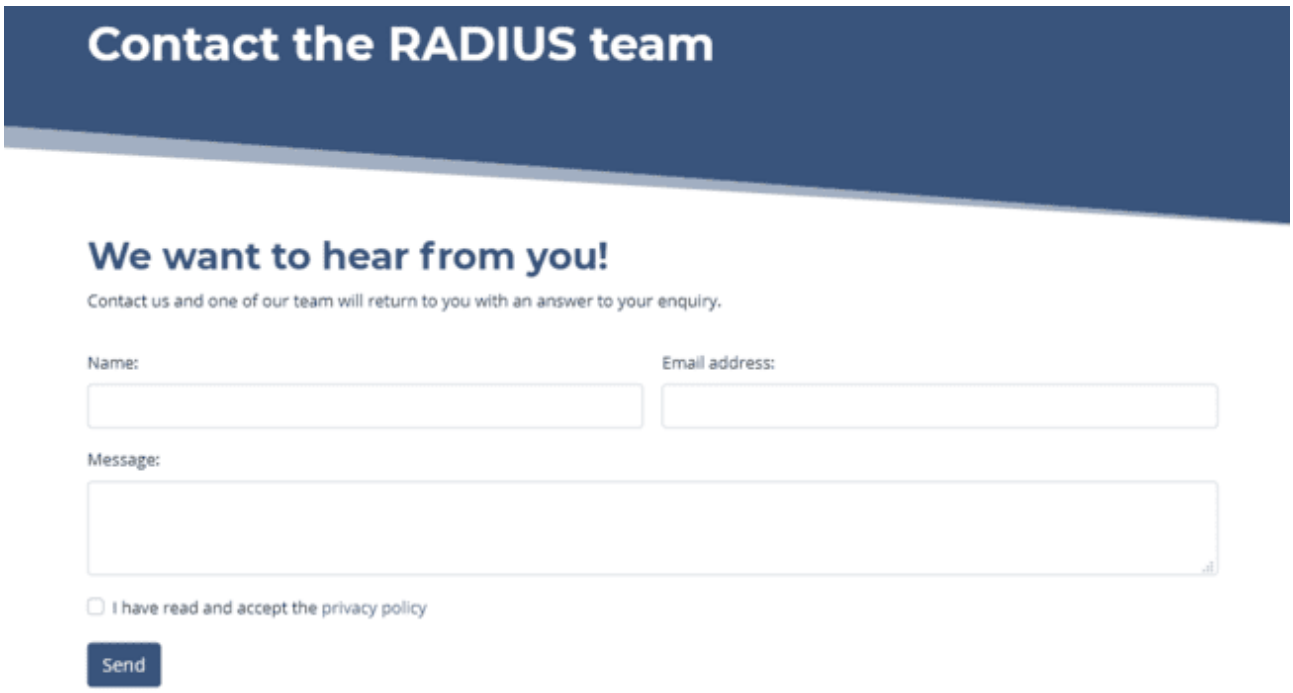

Figure 16 – Contact page

9.1.7 Private section

The private section will only be available to users registered on the system, i.e. representatives of the GSA, members of the AB and project partners. It will host supplemental material not available to the general public.

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9.2 Social media channels

The following social media profiles have been created.

Linkedin

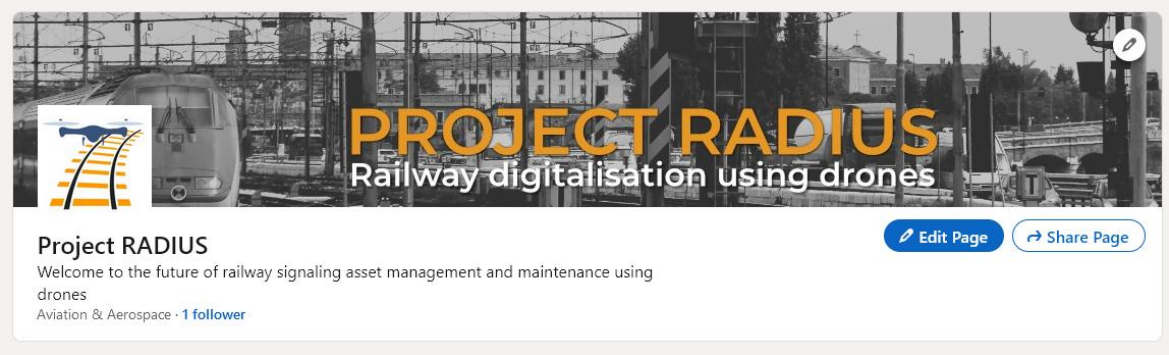

Figure 17 – RADIUS Profile on Linkedin

Twitter

Figure 18 – RADIUS Profile on Twitter

Figure 19 – RADIUS Channel on YouTube

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9.3 Video

The project video will be 2–3-minute animated cartoon describing the three high-level messages using non-technical language. It will provide a very fast and excellent introduction to the project and is suitable for all audiences.

The video will be available on the YouTube channel and a downloadable version will be included on the documentation section of the website.

9.4 Brochure

A brochure including the key messages, timeline and participants is available to all the project partners for use in promoting the project at any public venue.

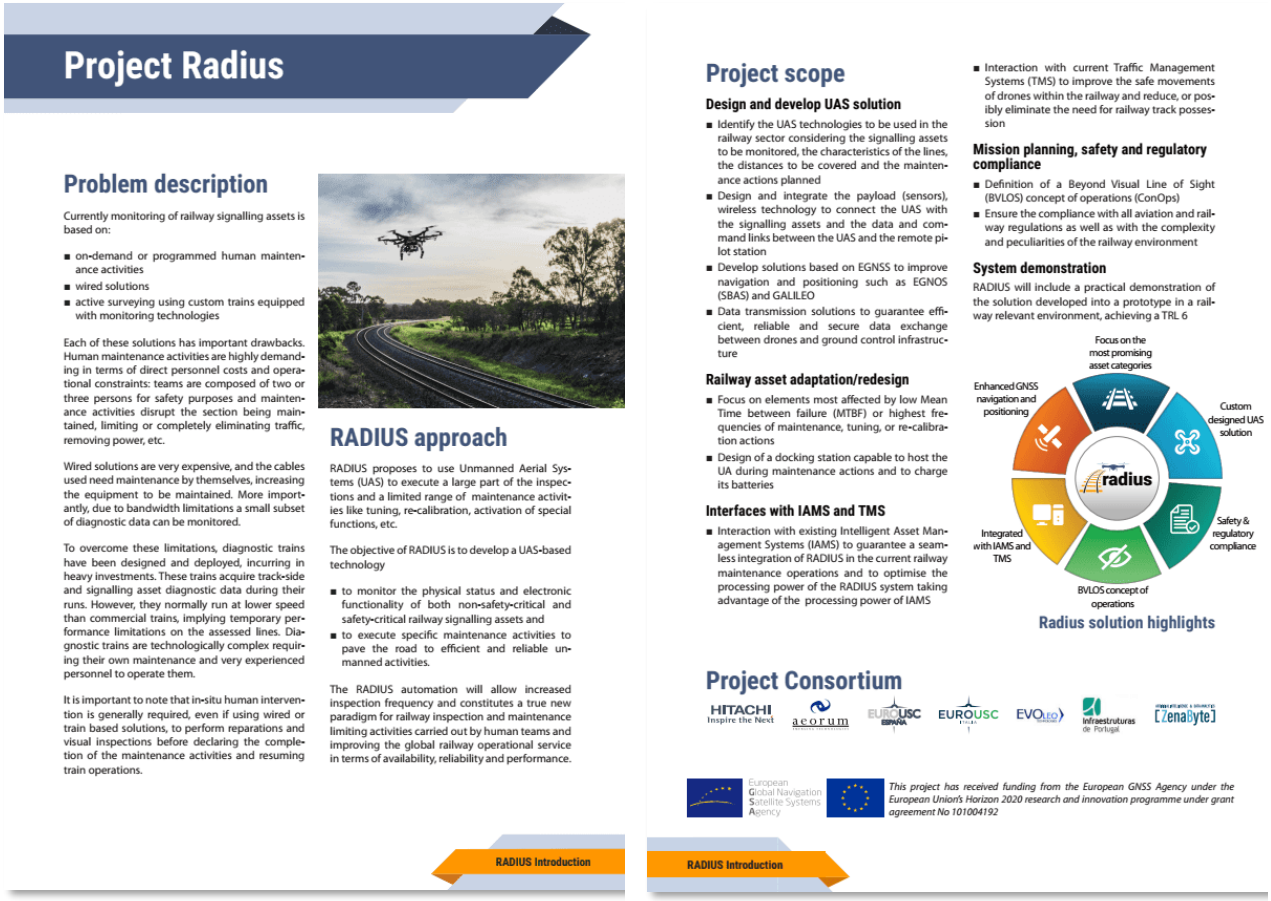

Figure 20 – RADIUS Brochure

10 Cross-fertilisation activities

10.1 Benefits of cross fertilization

Research should not take place in isolation. Innovation is all about exploring new possibilities, outside of preconceived ideas. Successful business ecosystems are characterised by the free interchange of ideas between different actors that translate into new products and services, sometimes discovering derivative applications that were not even considered by the creators of the original technologies.

The most obvious benefit of cross fertilization is the identification of redundant areas of research that are being actively pursued by other project, thus ensuring the most effective use of resources is allocated, reducing as much as possible a wasteful duplication of efforts.

But there are other direct benefits of the cross-fertilization efforts, as shown on the following diagram:

Figure 21 – The four benefits of cross-fertilization

These benefits are:

[1] **Optimization of resources**: As mentioned above, cross-fertilization ensures that resources are not wasted pursuing results that are already available or will become available in the future.

[2] **Specify and refine requirements**: Other projects could potentially benefit from the RADIUS services and, in return, can provide valuable information to identify the requirements that have to be fulfilled in order for these services to be potential users of the RADIUS services that they could use.

[3] **Validate the approach**: Other projects can be considered “use cases” or “early users” of the RADIUS services that complement the validation exercises that will be carried out as part of the RADIUS study.

[4] **Cross-promotion**: Interaction with other projects provides access to reach other audiences that are not the primary focus of RADIUS and thus increase the outreach of the project.

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10.2 Cross fertilization methodology

To achieve these benefits, the methodology shown on the figure below will be followed:

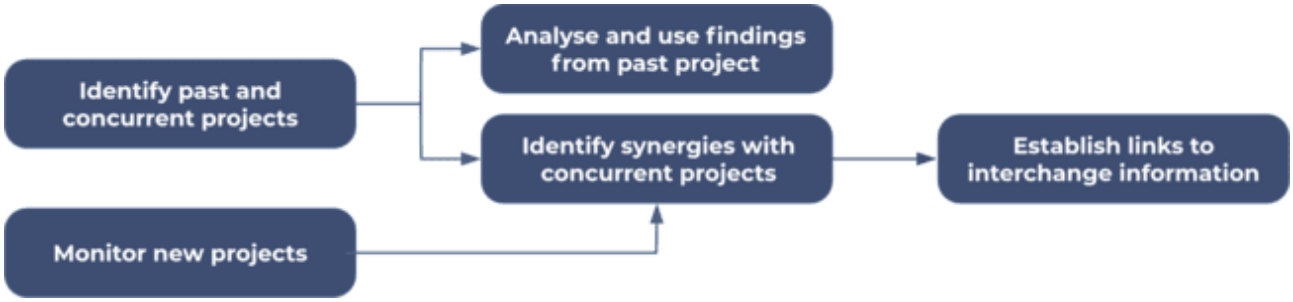

Figure 22 – Cross fertilisation methodology

1. **Identify past and concurrent projects**: The first step is to identify which projects are more interesting to our study in terms of the four potential benefits described in the previous section.
2. In the case of projects that have already finished it will not be possible to influence them to consider incorporating our research (thus the validation and cross-promotion benefits are not possible) but they have the advantage that their findings are published and can be **analysed to be considered as input by RADIUS**.
3. In the case of concurrent projects, their objectives and proposed methodologies can be analysed to **identify the most promising synergies** that can be obtained through cooperating with them.
4. Once these synergies have been determined, it will be possible to **establish appropriate links** with them for interchanging information.
5. The process of **discovery of potentially useful projects** should be maintained during the whole lifetime of the project as new projects can be started after the initial analysis.

10.3 External projects considered for cross-fertilisation

RADIUS will exploit the outcomes of the past and concurrent research projects considering the findings and recommendations, as well as the lessons learned from them.

The following projects have been considered:

Project	Description	Relation to RADIUS
MOMIT	The MOMIT project aims at developing and demonstrating a new use of remote sensing technologies for railway infrastructures monitoring. MOMIT solutions will mainly aim at supporting the maintenance and prevention processes within the infrastructure management lifecycle.	Even if MOMIT and DESTination RAIL concentrate on the monitoring large railway infrastructure and related matters (e.g. engineering works, soil slopes, ground movements, natural hazards, catenary monitoring, etc.) their results are extremely important for RADIUS for what concerns flying
DESTination RAIL	The aim of DESTination RAIL is to provide solutions for several problems faced by EU infrastructure managers. Novel techniques for identifying,	

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Project	Description	Relation to RADIUS
	analysing and remediating critical rail infrastructure will be developed. This includes drones to remotely monitor the condition of a soil or rock slopes.	and obstacle avoidance solution in railway areas.
5G!Drones	The project will drive the UAS verticals and 5G networks to a win-win position, on one hand by showing that 5G is able to guarantee UAS vertical KPIs, and on the other hand by demonstrating that 5G can support challenging use-cases that put pressure on network resources, such as low-latency and reliable communication, massive number of connections and high bandwidth requirements, simultaneously.	RADIUS will evaluate the possibility to liaise with 5G!Drones to exchange data and experiences collected using 5G in the railway use case.
AEROWORKS	The AEROWORKS robotic team consisted of multiple heterogeneous "collaborative Aerial Robotic Workers", a new class of Unmanned Aerial Vehicles equipped with dexterous manipulators, novel physical interaction and co-manipulation control strategies, perception systems, and planning intelligence.	Even if the field of application of these two projects is completely different, RADIUS will consider their findings in its design phase.
AEROARMS	AEROARMS objective was the research and development of aerial manipulation methods and technologies required to perform the industrial inspection and maintenance.	
GAUSS	The GAUSS project aims at fast and thorough achievement of acceptable levels in terms of performance, safety and security for both, current drone and future U-Space operations. The key element within GAUSS is the integration and exploitation of Galileo-EGNOS exceptional features for precise and secure positioning to enable U-Space operations, supporting the management and coordination of all drones in the VLL airspace.	RADIUS will consider GAUSS output for the design of the augmented positioning system.
PercEvite	PercEvite will develop a sensor, communication, and processing suite for small drones for autonomously detecting and avoiding "ground-based" obstacles and flying objects. To avoid ground-based obstacles, PercEvite aims for a lightweight, energy-efficient sensor and processing package that maximizes payload capacity.	RADIUS will take into account PercEvite results for the system specifications and for the design of the payload to improve railway obstacle avoidance.
NASA UTM – UAS Traffic Managemen	Building on its legacy of work in air traffic management for crewed aircraft, NASA is researching prototype technologies for a UAS Traffic Management (UTM) system that could	NASA is also working on UAS cybersecurity aspects and the coordination with NASA programme will be achieved through participation to the several

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Project	Description	Relation to RADIUS
	develop airspace integration requirements for enabling safe, efficient low-altitude operations	initiatives active on the UAS cybersecurity aspects.
CRUISE	CRUISE aims to develop and implement technologies and applications for the validation of cyber-security in transport and remote or autonomous driving platforms.	RADIUS will consider the outcomes of these demonstration projects as relevant.
SECOPS	The main objective of SECOPS is to define such an integrated security concept for drone operations that ensures that security risks in U-space are mitigated to an acceptable level, more specifically: 1) Drones do not divert from their intended mission, due to unexpected interference; 2) Drones cannot deliberately be misused for illegal or dangerous activities; 3) Detect and act when drones are misused (by the pilot or an external party).	
DROC2OM	DROC2OM targets the datalink of Unmanned Aerial Systems (UAS), aiming for the integration of drones into civil airspace, i.e. enabling the sharing of the airspace between manned and unmanned systems	
SIA	SIA has the objective of developing 4 ready-to-use new services to provide prognostic information about the health status of the railway's most demanding assets in terms of maintenance costs (wheel, rail, pantograph and catenary)	Even if SIA is not focused on the use of UASs, it could provide interesting results for RADIUS on the localization precision within the railway environment.
EGNSS4RPAS	Technical and financial studies aiming at supporting the standardisation process for EGNSS in drones	The EGNSS4RPAS output will be one of the cornerstones on which RADIUS will develop, starting from the published white paper
STARS	The STARS project paves the way for the future EGNSS deployment in safety relevant railway applications. By evolving the highly developed and deployed ERTMS standard through the implementation of the satellite positioning functionality, it will be possible to reduce the cost of the future railway signalling systems, especially for lines with lower traffic density. The project deals with three main topics: 1) The elaboration of reference data and characterisation of the railway environment through a measurement campaign; 2) The assessment of the EGNSS performances achievable in the railway environment with the determination of the applicable requirements for the positioning system as well as the necessary evolutions of EGNSS services and ERTMS/ETCS functions and 3) Quantification of the economic	Despite the project being focused on train positioning for signalling, all studies and results obtained7 will be taken into account since they constitute an extremely important basis localisation purposes also in RADIUS. STS, as partner of STARS, will use these results as background knowledge for RADIUS

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Project	Description	Relation to RADIUS
	benefits and specifying the possible implementation roadmap when applying the EGNSS on railways.	
HELMET	The main objective of HELMET is to develop innovative EGNSS applications capable to impacting on eco-friendly and green transportations means. Target adopters of EGNOS and Galileo are the Connected and driverless cars, Train signalling, UAS for surveillance of roads and railways	HELMET is focused on train positioning for signalling and multimodality, whose results could be of interest for RADIUS. RADIUS will seek synergies with HELMET exploiting the fact that STS is part of the RadioLabs consortium that coordinates the project

Table 7 – List of relevant projects considered for cross-fertilisation

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11 Success Criteria

11.1 Key Performance Indicators (KPI)

The following table shows the performance indicators that will be used to assess the success of the dissemination and communication activities:

KPI	Metric
Design of project logo and templates	1 each
Production of banners, posters and brochures	1 each
Production of newsletter	Twice a year
Production of video material introducing RADIUS objectives	1
Active website	1 website and ≥ 2000 unique visitors as trend towards project's end
Social media and other electronic activities engagement	≥ 100 individuals/organisations signed up to receive email updates on project achievements and results by the end of Y1 ≥ 500 by the end of the project; ≥ 1 blog entry per quarter along the project duration; ≥ 500 Twitter followers; ≥ 200 members on LinkedIn Group
Develop RADIUS stakeholders' database	≥ 800 contacts (50 contacts per partner)
Partners´ participation in external conferences, and workshops	Minimum of 4 events/year
Press releases to traditional media	≥ 6
White papers	≥ 2

Table 8 – Dissemination and communication KPI

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12 References

[1] RADIUS Grant Agreement 101004192

[2] Communicating EU research and innovation guidance for project participants – Version 1.0 – Date: 25 September 2014

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