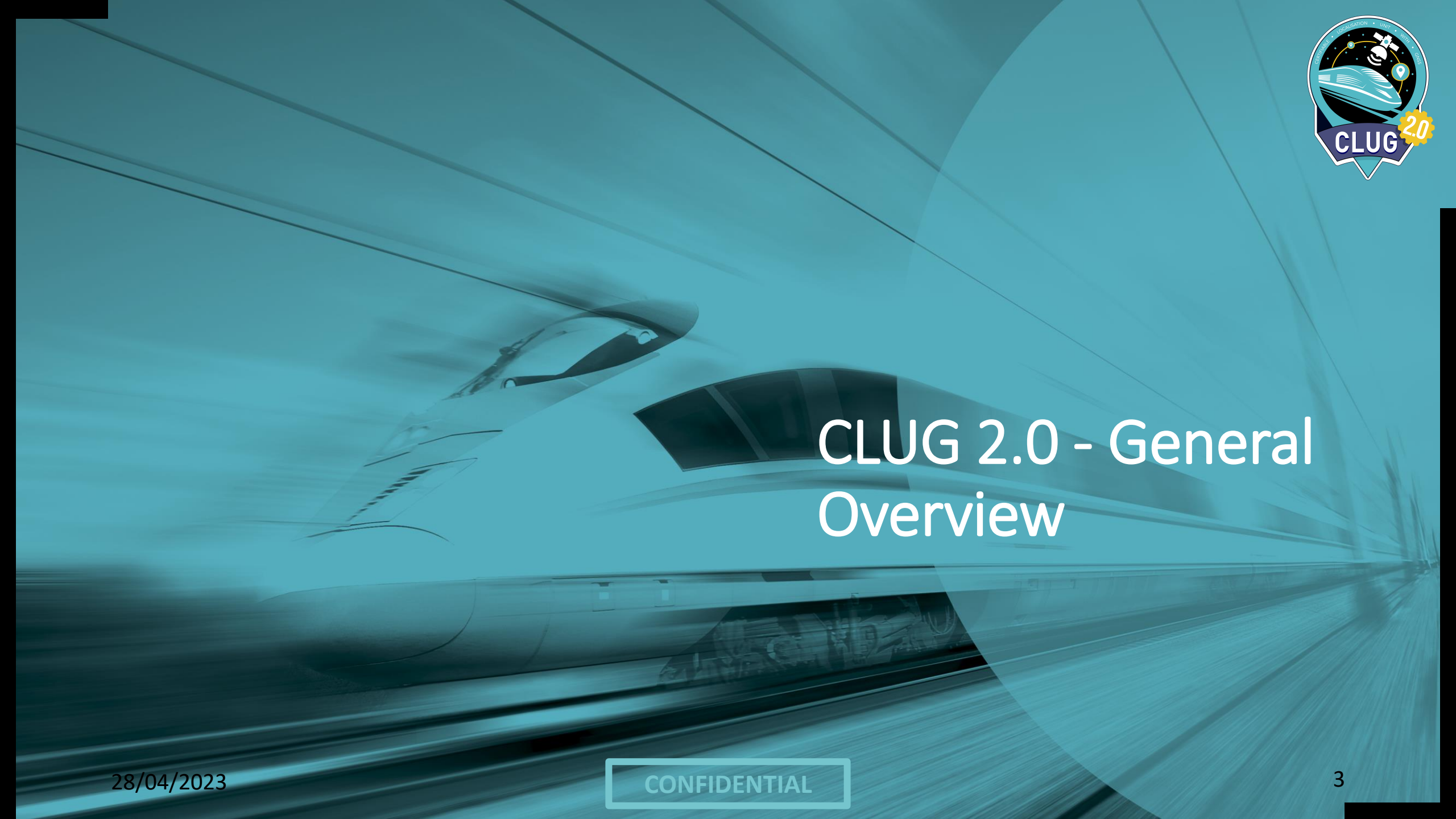
EUSPA
European Union Agency for the Space Programme

CLUG 2.0 KoM

8th of March 2023

AGENDA OF THE MEETING

9:00 - 9:10	Welcome by Jose Bertolín Project Coordinator (UNIFE), Daniel Lopour Project Officer (EUSPA)
9:10 - 9:15	Introduction to ERJU programme and potential collaboration with CLUG 2.0, Lea Paties (ERJU)
9:15 - 9:30	Introduction to CLUG 2.0, J. Bertolín (UNIFE)
9:30 - 10:00	CLUG 2.0 technical presentation, V. Barreau (SNCF)
10:00 - 10:20	Project Management, J. Bertolin (UNIFE), M Kayalova (RINA-C)
10:20 - 10:40	WP2 LOC-OB System Definition & Requirements Specification, B. Valles (DBN)
10:40 - 11:00	WP3 - RAMS Analysis, M. Sarrat (SNCF)
11:00 - 11:15	*Coffee Break*
11:15 - 11:45	WP4 - Design & Development, A. Sfeir (ADS)
11:45 - 12:15	WP5 - Integration & Testing (including Site Demonstrator), Bernhard Stamm (SMO)
12:15 - 12:35	WP6 - Dissemination + Standardization and Business Case, J. Bertolin (UNIFE), Ananthakrishna Irvathraya (DBN) and Robin Von-Hammerstein (DBN)
12:35 - 13:05	Risk Analysis, Valentin Barreau (SNCF)
13:05 - 13:15	Q&A
13:15 - 13:20	**Closing Remarks**, J. Bertolín (UNIFE), V. Barreau (SNCF)
13:20	*Lunch*



CLUG 2.0 - General Overview

CLUG 2.0 IN A NUTSHELL

Budget: **3.1 M€**
2.87 M€ (EUSPA FUNDED)

Partners: **10**

Duration: **24 months**

Starting date: **Feb 23**

End date: **Jan 25**

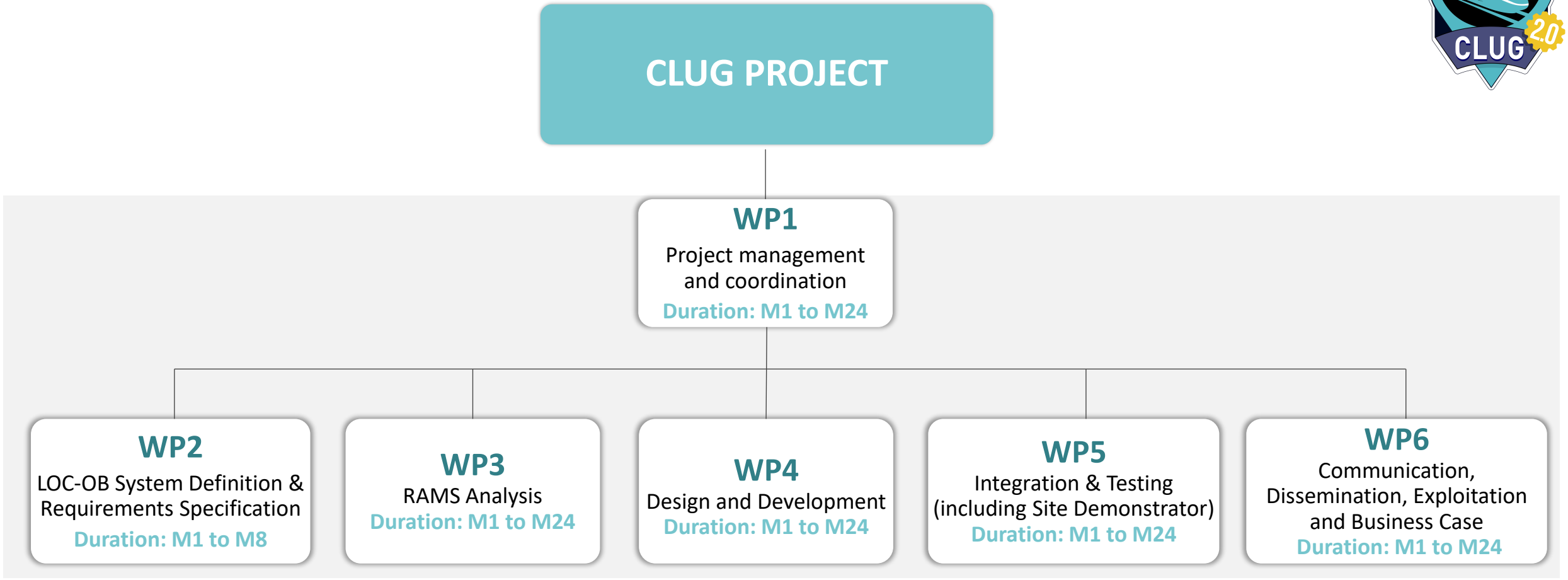
CLUG 2.0 OBJECTIVES

Develop and demonstrate absolute safe train positioning by applying the existing and future European Global Navigation Satellite System (GNSS) and the European Geostationary Navigation Overlay Service (EGNOS) and multi-sensor functionality for train localization.

The expected objectives of CLUG 2.0 are based on work performed in CLUG (along the track)

- Consolidation of user needs and system requirements (**Along Track**, Start of Mission and Track selectivity)
- Consolidation of safe localization system architecture and prototype new critical functionality
  - Track Selectivity and Safety
  - Sensor and system levels FDE algorithms
  - Confidence Intervals computation and global Integrity concept
- RAMS analysis on the consolidated functional architecture of the system.
- Live demonstration/Replay to consolidate readiness of the CLUG multi-sensor fusion algorithms

WP ORGANIZATION



CLUG 2.0 PROJECT PLAN

Legend: ♦ Milestones

	WP / Tasks	Leader	Contributors	Dur.	From M	to M
WP1	Project Management & Technical Coordination	UNIFE		24	1	24
T1.1	Project Management/Coordination	UNIFE	RINA-C	24	1	24
T1.2	Consortium Management	RINA-C	UNIFE	24	1	24
T1.3	Technical Coordination	SNCF	DBN, SBB, SMO, ADS-F, UNIFE, ENAC, CAF, SYN?	24	1	24
T1.4	Administrative and Financial Management	RINA-C	UNIFE	24	1	24
T1.5	Quality Management	RINA-C	UNIFE	24	1	24
WP2	LOC-OB System Definition & Requirements Specificatic	DBN		8	1	8
T2.1	Operational needs and system capabilities of LOC-OB	DBN	SCNF,SBB	8	1	8
T2.2	Start of Mission and track selectivity	DBN	SNCF, SBB, SMO, CAF, ADS	8	1	8
T2.3	LOC-OB System Boundary, Architecture and External Interfaces incl. Digital Map	SBB	SNCF, DBN, SMO, CAF, ADS	8	1	8
T2.4	LOC-OB System Requirement Analysis and Specification	SNCF	SBB, DBN, SMO, CAF, ADS	8	1	8
WP3	RAMS Analysis	SNCF		24	1	24
T3.1	CLUG LOC-OB System context analysis and RAMS Plar	SNCF	DBN, SMO, CAF, ADS	6	1	6
T3.2	LOC-OB Preliminary Hazard Analysis	SNCF	DBN, SMO, CAF, ADS	6	3	8
T3.3	CLUG LOC-OB System Failure Modes and Effects Analy	SNCF	DBN, SMO, CAF, ADS	6	11	16
T3.4	LOC-OB External Interface Analysis	SNCF	DBN, SMO, CAF, ADS	6	9	14
T3.5	CLUG LOC-OB System Functional Analysis	DBN	SNCF, SMO, CAF, ADS	6	11	16
T3.6	CLUG LOC-OB Reliability Availability Maintainability Sy	SMO	SNCF, DBN, CAF, ADS	6	11	16
T3.7	CLUG LOC-OB RAMS Evaluation report	SNCF	DBN, SMO, CAF, ADS	9	16	24
WP4	Design and Development	ADS		24	1	24
T4.1	LOC-OB functional architecture	ADS	SMO, ENAC, SNCF, SBB, DBN, SMO, SYN	20	1	20
T4.2	GNSS+EGNOS unit sensor including data FDE	SYN	ENAC, ADS-F, SNCF DBN	18	1	18
T4.3	IMU sensor and data FDE	CAF I+D	SNCF, ADS-F, DBN	15	1	15
T4.4	Speed sensor (tacho or eq.) and data FDE	SMO	CAF, ADS-F, DBN	10	1	10
T4.5	Eurobalise reader sensor and data FDE	SMO	CAF, ADS-F, DBN	10	1	10
T4.6	Along track localization algorithm robustification	ADS	ENAC, SNCF, DBN	15	1	15
T4.7	Confidence Intervals computation & Integrity algorithm	ADS	ENAC, DBN	15	1	15
T4.8	Track Selectivity algorithm	ADS	ENAC, SNCF, DBN	15	1	15
T4.9	Start of Mission preliminary definition	SNCF	DBN, SMO, ADS-F, SYN	15	4	15
T4.10	On board Digital Map Integration	SMO	SBB, ADS-F	8	1	8
T4.11	CLUG LOC-OB system Performances engineering (Integrity Availability)	ADS	ENAC, SMO, DBN, SNCF	15	6	20
T4.12	EGNOS data generation made available for tests	ADS	SMO, SYN	24	1	24
WP5	Integration & Testing (includ Site Demonstrator)	SMO		24	1	24
T5.1	Raw Data Collection System	SMO	SBB	21	1	21
T5.2	Onboard Site Demonstrator	SMO	ADS-F, SYN	24	1	24
T5.3	Data Collection and Live Demonstration	SMO	SBB, CAF I+D, SNCF, DBN	19	6	24
T5.4	Data Post Processing	SMO		19	6	24
T5.5	Data Analysis and Interpretation	SMO	ADS, SNCF, DB, SBB	19	6	24
WP6	Communication, Dissemination, Exploitation and	UNIFE		24	1	24
T6.1	Develop the Communication, Dissemination and Exploitation Plan (CDEP)	UNIFE	DBN, SNCF, SBB, SMO, ADS-F, ENAC, CAF I+D, SYN	4	1	4
T6.2	Production and maintenance of Data Management	UNIFE	SNCF, DBN, ADS-F, SMO	24	1	24
T6.3	Project communication and dissemination activities	UNIFE	DBN, SNCF, SBB, SMO, ADS-F, ENAC, CAF I+D, SYN	24	1	24
T6.4	Scientific Dissemination	SNCF	ENAC	24	1	24
T6.5	Business case for GNSS based absolute safe train positioning	DBN	SNCF, SBB, SMO, CAF I+D	13	12	24
T6.6	Definition of Modular and Interoperable LOC-OB system for future Standardisation	DBN	SNCF, SBB, SMO ,CAF I+D, ADS-F	9	16	24
T6.7	Exploitation commitee	UNIFE	DBN, SNCF, SBB, SMO, ADS-F, ENAC, CAF I+D, SYN	19	6	24

2023: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec — 2024: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

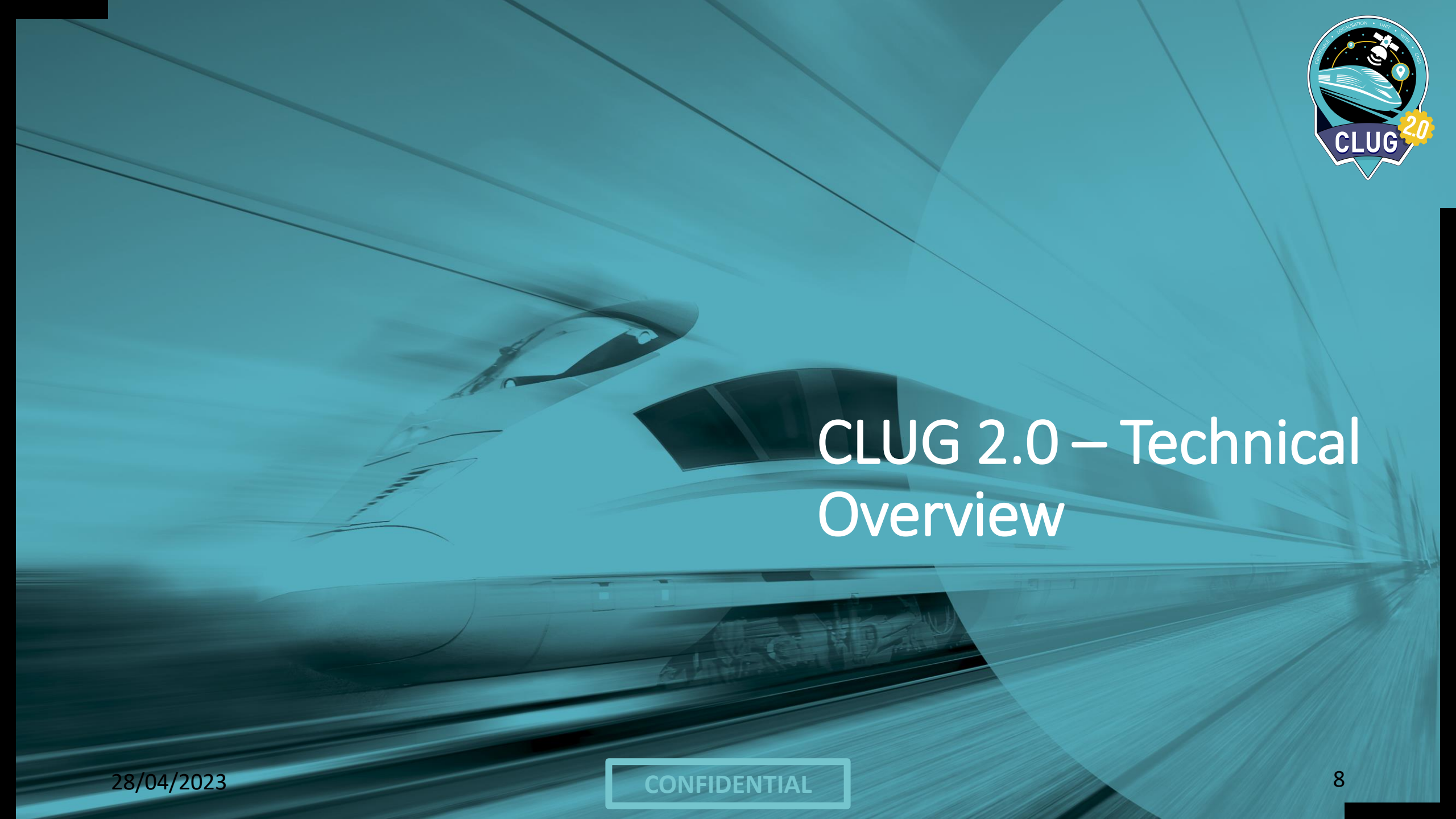
Year 1 | Year 2

Phase 1 | Phase 2 | Phase 3

M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12 M13 M14 M15 M16 M17 M18 M19 M20 M21 M22 M23 M24

MS1 MS2 MS3 MS4 MS5

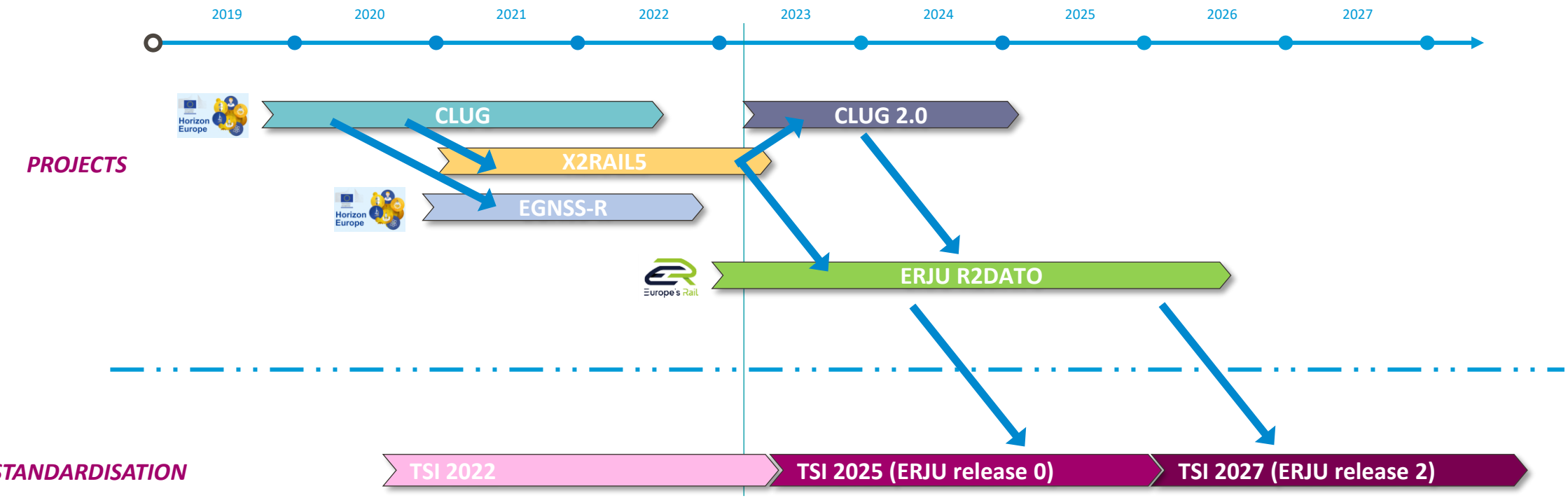
D1.1 D2.1 D2.2 D2.3 D2.4 D3.1 D3.2 D3.3 D3.4 D3.5 D3.6 D3.7 D4.1 D4.2 D4.3 D4.4 D4.5 D4.6 D4.7 D4.8 D4.9 D4.10 D4.11 D5.1 D5.2 D5.3 D6.1 D6.2 D6.3 D6.4 D6.5 D6.6



CLUG 2.0 – Technical Overview

CLUG REASONING & ROADMAP

- Demonstrate the feasibility of using EGNSS in rail signaling solutions (in term of operations and performance)
- Validate the critical points regarding standardization (migration, interfaces, etc)



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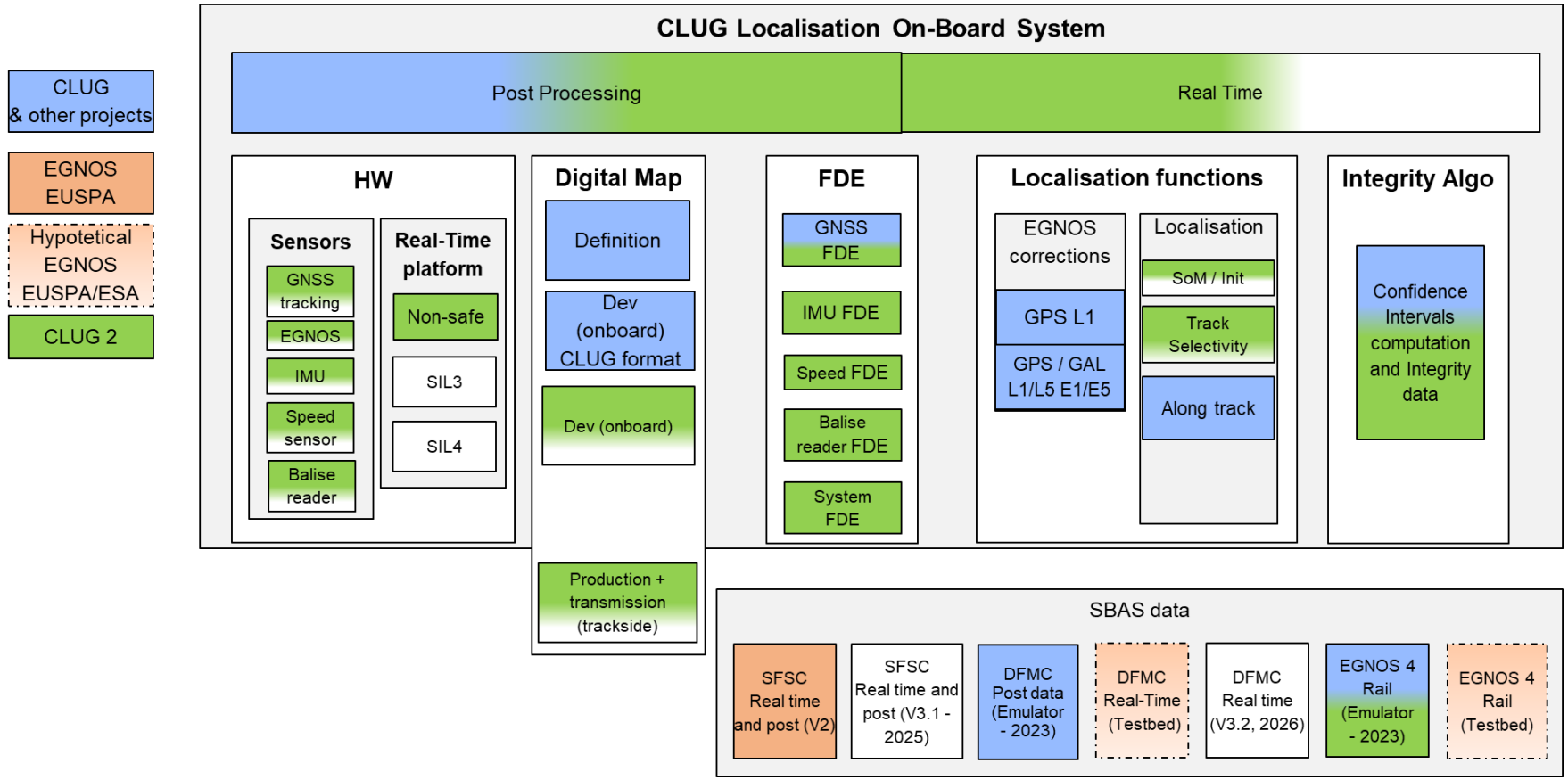


PROJECT EXPECTATIONS (TRL)

Project expectations (TRL)

PROJECT EXPECTATIONS (TRL)

		TRL at Project Start	TRL at Project End	Function demonstration at project end
Hardware	Unsafe Real-Time platform	TRL3	TRL7	Live
	Sensors (Balise reader & speed)	TRL9	TRL9	Live
	GNSS+EGNOS	TRL4	TRL7	Live
	IMU	TRL5	TRL7	Live
Digital Map	Onboard	TRL4	TRL7	Live
	Trackside (generation)	TRL5	TRL5	Out of project scope
	Transmission	TRL1	TRL2	Design & Test
Fault Detection & Exclusion	Sensors data FDE (GNSS, IMU, Speed, Balise)	TRL3	TRL6 / 7	Replay, maybe live
	System data FDE	TRL3	TRL6 / 7	Replay, maybe live
Localisation functions	Along Track algorithm	TRL5	TRL7	Live
	Track Selectivity	TRL3	TRL5	Replay
	Start of Mission	TRL1	TRL2	Design & Test
Integrity Algorithm	CI computation and integrity	TRL 3	TRL5	Replay, maybe live in option pending external projects
Usage of EGNOS services	EGNOS SF (V2 or V3.1)	TRL 9	TRL 9	Live
	EGNOS DFMC (V3.2)	TRL 4	TRL 6	Replay, maybe live in option pending external projects
	EGNOS complement data for rail	TRL 2	TRL 5	Replay

Project Management

OBJECTIVES & TASKS

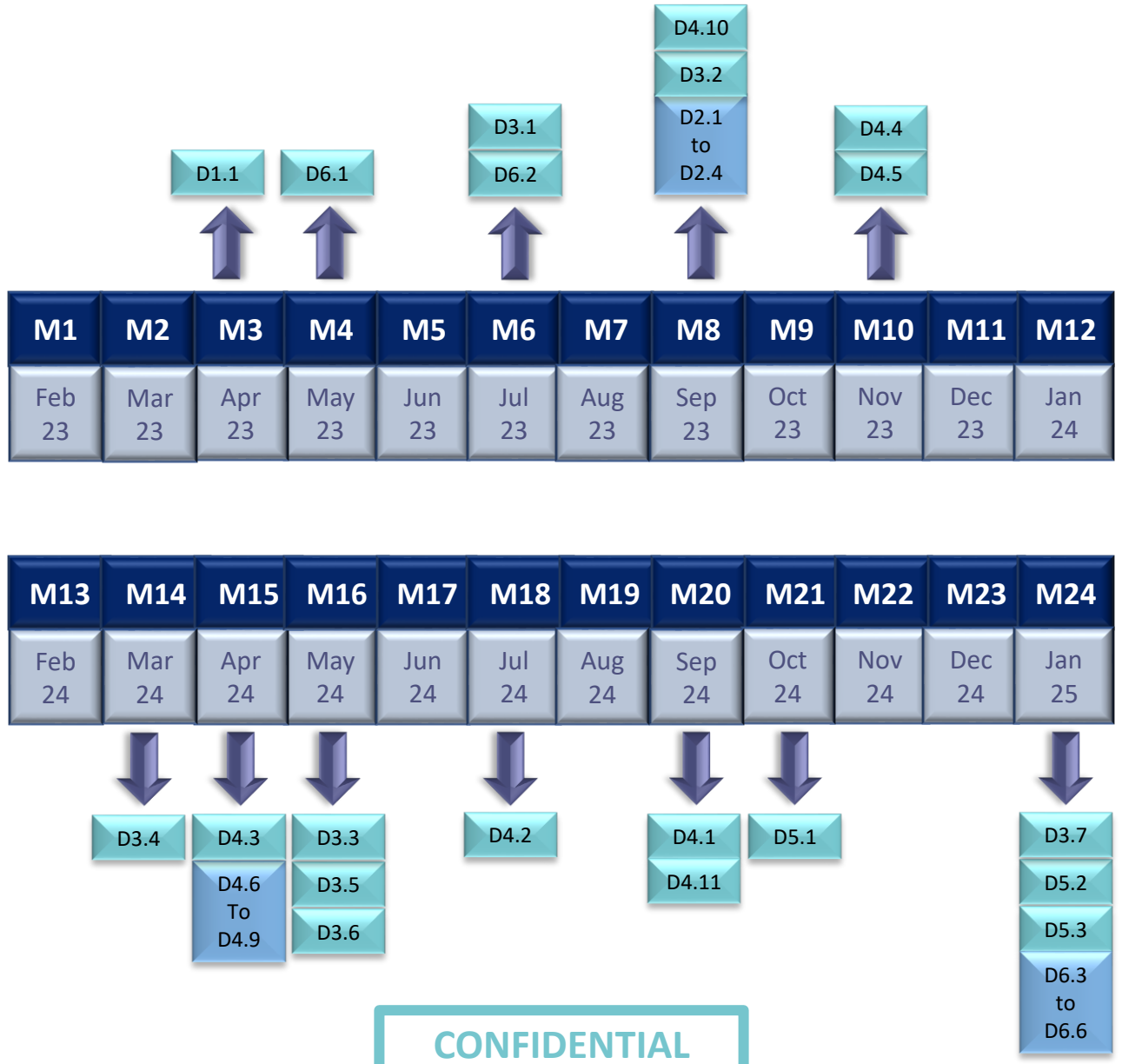
Objectives

Establish a **flexible and efficient project management structure** and processes together with the provision of an effective **risk management strategy**

	Task contributors		
	Leader	Contributor	Reviewer
Project Management/Coordination	unife	RINA	
Consortium Management	RINA	unife	
Technical Coordination	SNCF	DB, SBB, ENAC, CAF, unife, SIEMENS, AIRBUS, syntony GNSS	
Administrative and Financial Management	RINA	unife	
Quality Management	RINA	unife	

Duration: M1 to M24

CLUG 2.0 DELIVERABLES



PROJECT MANAGEMENT

Reporting periods

- Reporting period 1 (RP1) (M1-M12) => February 2023 – January 2024
- Reporting period 2 (RP2) (M13-M24) => February 2024 – January 2025

The coordinator must submit to EUSPA a periodic report (both technical and financial) within **60 days** of the end of the reporting period => **February&March 2024/2025**

PROJECT MANAGEMENT

Periodic report - Structure

Periodic report ⇨ submitted by coordinator 60 days after end of reporting period

Periodic Technical Report

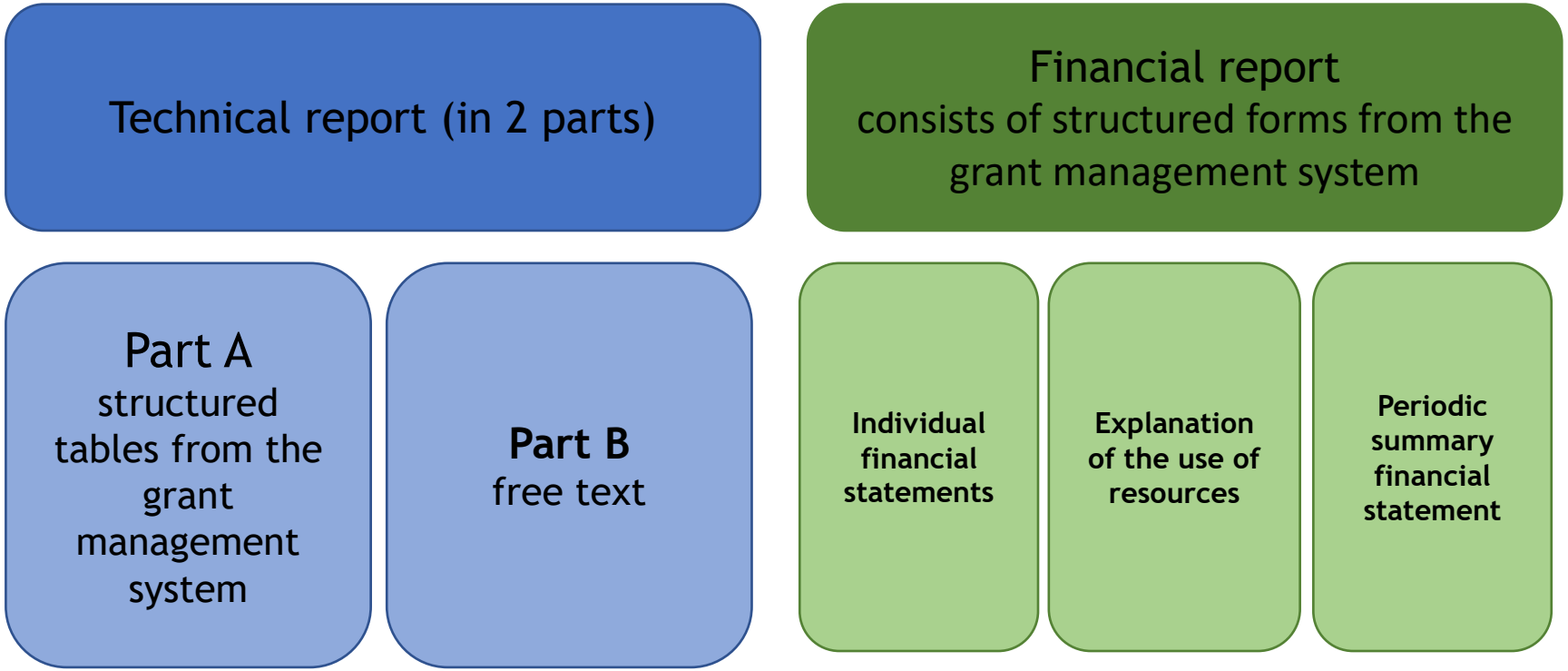
- ✓ explanation of the work carried out
- ✓ overview of progress (milestones and deliverables)
- ✓ summary for publication
- ✓ plan for the exploitation and dissemination of results (if required)
- ✓ answers to the questionnaire

Periodic Financial Report

- ✓ Financial Statement (individual & summary)
- ✓ Explanation of the use of the resources

PROJECT MANAGEMEN

Periodic report - Structure



PROJECT MANAGEMENT

Periodic report – Structure

Part A

- Structured tables : Summary for publication; Deliverables (continuous reporting); Milestones; Critical risks; Dissemination & Communication activities; Patents and Innovation; SME impact; Gender

Part B

1. **Explanation of work & Overview of progress** => Detailed work carried out per WP, an overview of project results towards the objective (including summary of deliverables and milestones) => **inputs from WP leaders**
2. Update of exploitation & dissemination plan
3. Update of data management plan
4. Follow-up of recommendations & comments from previous review(s) => Relevant for RP2 (recommendations & comments related to RP1)
5. Deviations from Annex 1 (DoA)
   5.1 Tasks => inputs from WP leaders
   5.2 Use of resources => done by RINA (analysis of financial data in the CT)

PROJECT MANAGEMENT

Quarterly reporting

- Every 3 months
- Quarterly report to be submitted as deliverable

D1.2	✔	Quarterly report n°1	UNIFE	R	SEN	3
D1.3	✔	Quarterly report n°2	UNIFE	R	SEN	6
D1.4	✔	Quarterly report n°3	UNIFE	R	SEN	9
D1.5	✔	Quarterly report n°4	UNIFE	R	SEN	12
D1.6	✔	Quarterly report n°5	UNIFE	R	SEN	15
D1.7	✔	Quarterly report n°6	UNIFE	R	SEN	18
D1.8	✔	Quarterly report n°7	UNIFE	R	SEN	21
D1.9	✔	Quarterly report n°8	UNIFE	R	SEN	24

PROJECT MANAGEMENT

Quarterly reporting

- Objectives (description, verification, actual date achieved, status,…)
- List of meetings
- Project KPIs
- Deliverables (expected/achieved date, status,…)
- Quarterly:
  - Summary of activities of last quarter
  - Main open issues, risks and mitigating actions
  - Next steps / Opportunities
  - Partners fully engaged?
  - Budget on track?
  - Project on schedule?
  - Deliverables on time?
  - Any major technical risk?
  - Any major market risk?

PROJECT MANAGMENT

Training session will be organised in the coming weeks

Internal accounting

- Every 6 months
- Consolidated financial data will be used for the official reporting to EUSPA

Project

Current Project: CLUG 2.0

Current Version: V1 10/01/2022

Domains

- CLUG_2
  - GAP
  - GEN

Account

Periods

Advanced | Clear | Add | Reset | Download

Period	Start Month	End Month	Start Date	End Date	Deadline Date	Status
R1 A1	1	6	01/02/2023	31/07/2023	14/08/2023	In progress
R1 A2	7	12	01/08/2023	31/01/2024	14/02/2024	Planned
R1	1	12	01/02/2023	31/01/2024	14/02/2024	Planned
R2 A3	13	18	01/02/2024	31/07/2024	14/08/2024	Planned
R2 A4	19	24	01/08/2024	31/01/2025	14/02/2025	Planned
R2	13	24	01/02/2024	31/01/2025	14/02/2025	Planned

PROJECT MANAGEMENT

Internal accounting in Cooperation tool

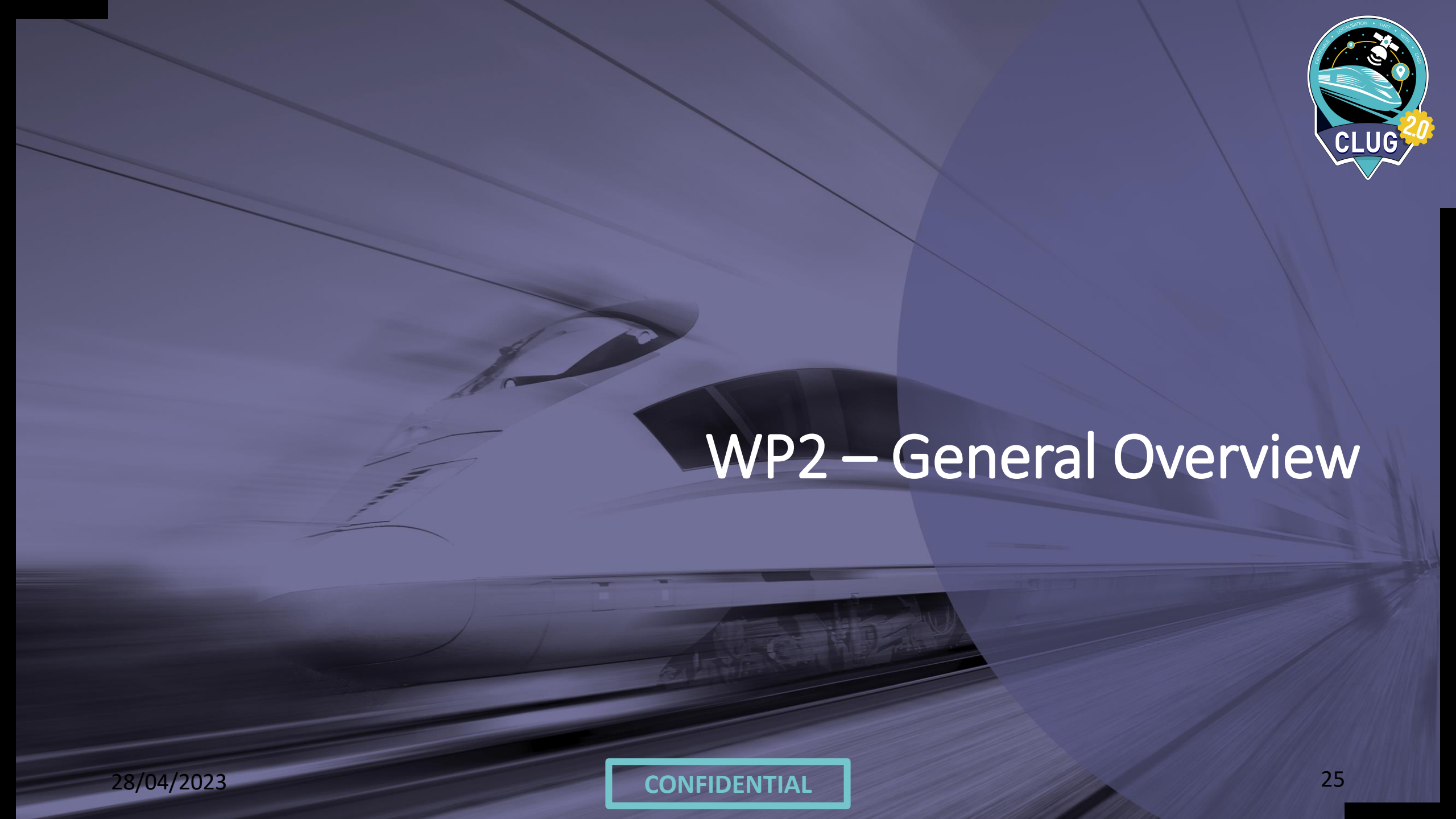
- Each beneficiary (+ affiliated entity) to report on Efforts (PMs), Personnel costs, Travels, Equipment, etc.

Categories Monitoring

A1 | RINAC | Ungroup AEs | Download

Cost Category	Budget	Account
Person Months	2,00	0,00
Personnel Costs	11.400,00	0,00
Travel	700,00	0,00
Equipment	0,00	0,00
Other goods and services	0,00	0,00
Costs of large research infrastructure	0,00	0,00
Subcontracting	0,00	0,00
Financial support to third parties (Article 15.1)	0,00	0,00
Specific categories of costs (Article 6.2F)	0,00	0,00
Total direct costs	12.100,00	0,00
Indirect costs	3.025,00	0,00
Total costs	**15.125,00**	**0,00**

WP2 - LOC-OB System Definition & Requirements Specification



WP2 – General Overview

WP PARTICIPANTS (DBN: WP LEAD)

Duration: M1 to 8

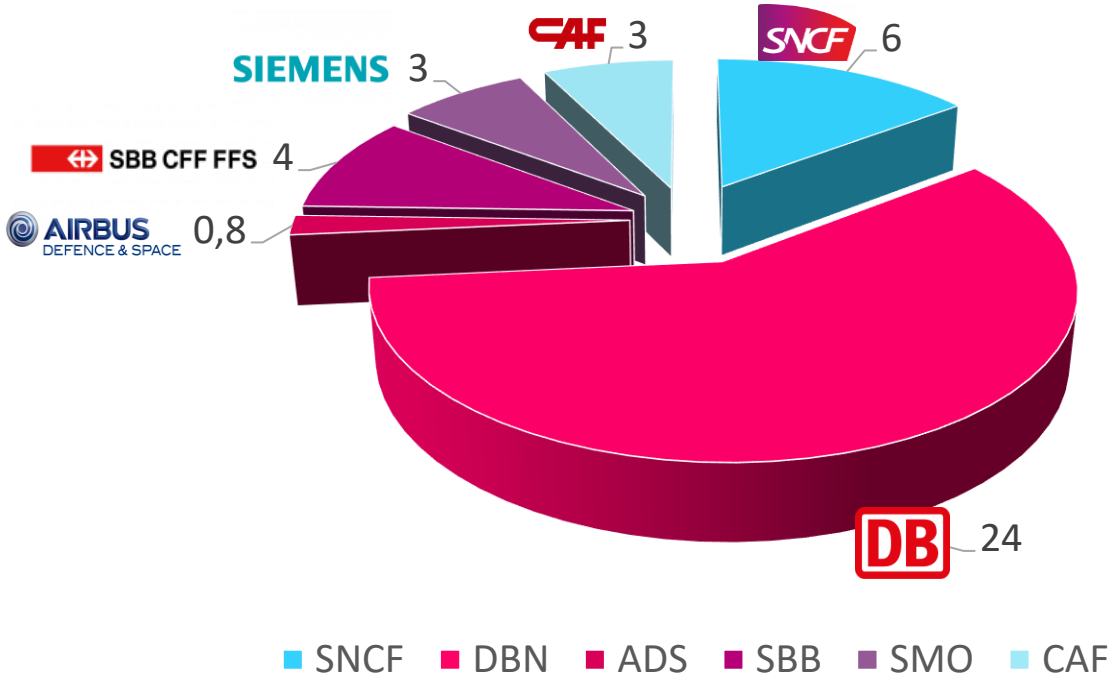
Budget: **40.8 person months**

14% of the total CLUG2 budget: 289.4pm

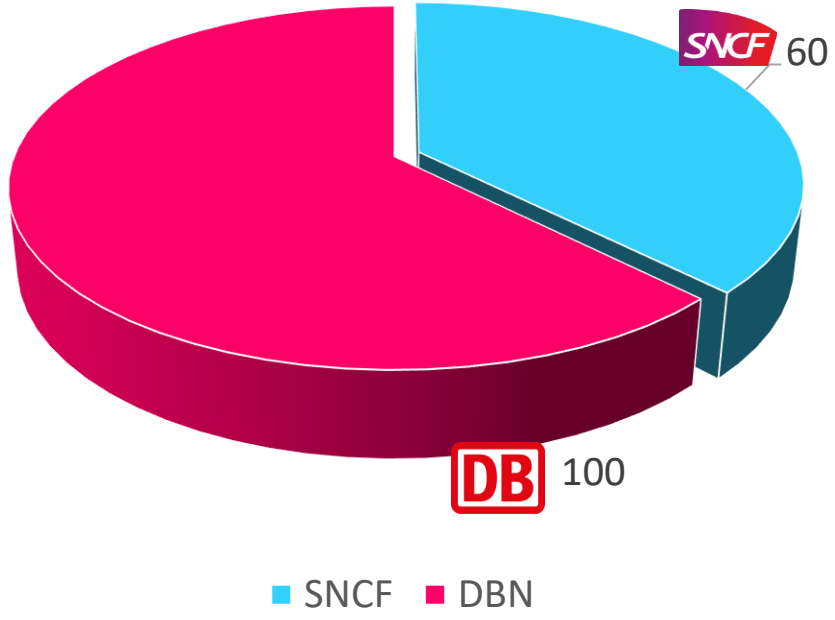
Subco: **160k€**

53% of the total CLUG2 subco: 300k€

WP2 Effort (person months) distribution among partners



Subco (k€) distribution among partners



WP2 OBJECTIVES

LOC-OB System Definition & Requirements Specification

Define the user needs, operational context, initial assumptions, system boundary and requirements including:

- Operational needs of IM and RU and system capabilities to be fulfilled by absolute safe train positioning.
- Operational scenarios including nominal and degraded scenarios with regards to Start of Mission and track selectivity.
- System context, functions, and constrains of a LOC-OB system.
- LOC-OB System requirements including functional and non-functional requirements.

WP2: LOC-OB System Definition & Requirements Specification

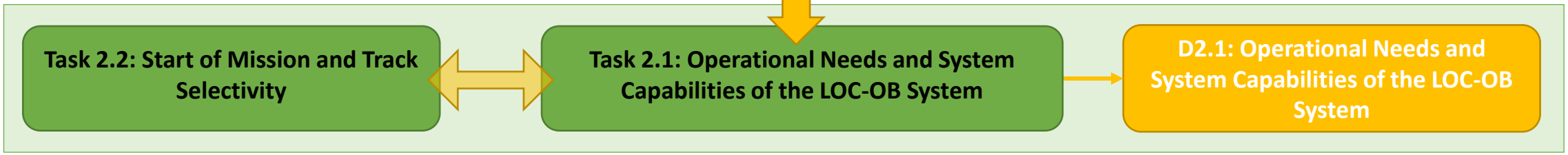
Objectives	Task contributors		
Specify LOC-OB High Level System Description	Leader	Contributor	Reviewer
Operational needs and system capabilities of LOC-OB system	DB	SNCF	SBB CFF FFS, DB, SNCF
Start of Mission and track selectivity	DB		SBB CFF FFS, DB, SNCF, AIRBUS DEFENCE & SPACE, SIEMENS, CAF
LOC-OB System Boundary, Architecture and External Interfaces incl. Digital Map	SBB CFF FFS	DB	SBB CFF FFS, DB, SNCF, AIRBUS DEFENCE & SPACE, SIEMENS, CAF
LOC-OB System Requirements Analysis and Specification	SNCF	DB	SBB CFF FFS, DB, SNCF, AIRBUS DEFENCE & SPACE, SIEMENS, CAF

WP2 - DESCRIPTION

Task 2.1: Operational needs and system capabilities of LOC-OB system

Define the needs and high-level requirements of IM and RU towards absolute safe train positioning including:

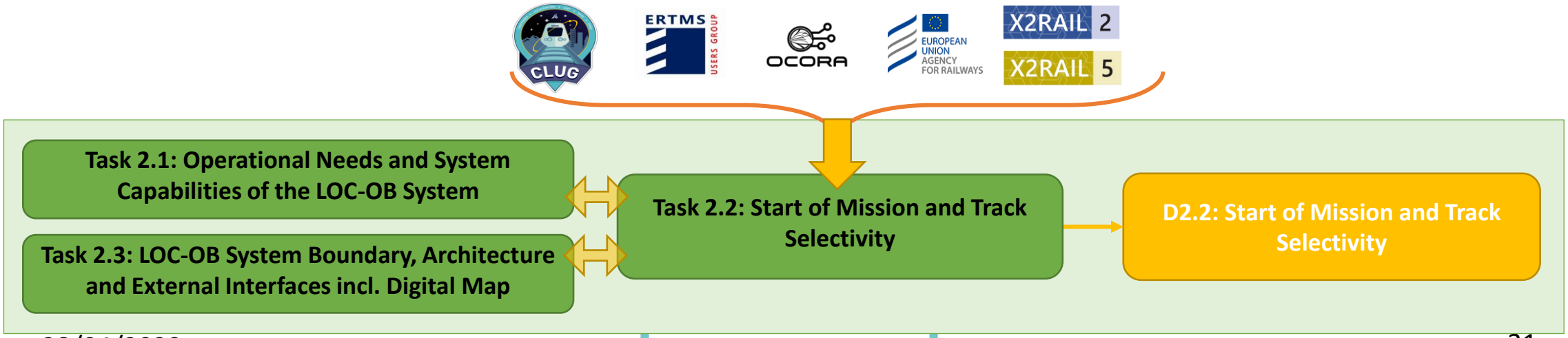
- Analysis and definition of the needs of IM and RU with focus on overall system performance, cost effectiveness and line capacity.
- Identification of potential constrains on the LOC-OB system.
- Analysis of the impact of localization accuracy on capacity.
- Identify wider system of interest.
- Derive system capabilities of LOC-OB system needed to fulfil high-level requirements of IM and RU.



Task 2.2: start of mission and track selectivity

Analyse and describe operational scenarios – Start of Mission and track selectivity that today are regarded as challenging for the on-board train positioning using GNSS including:

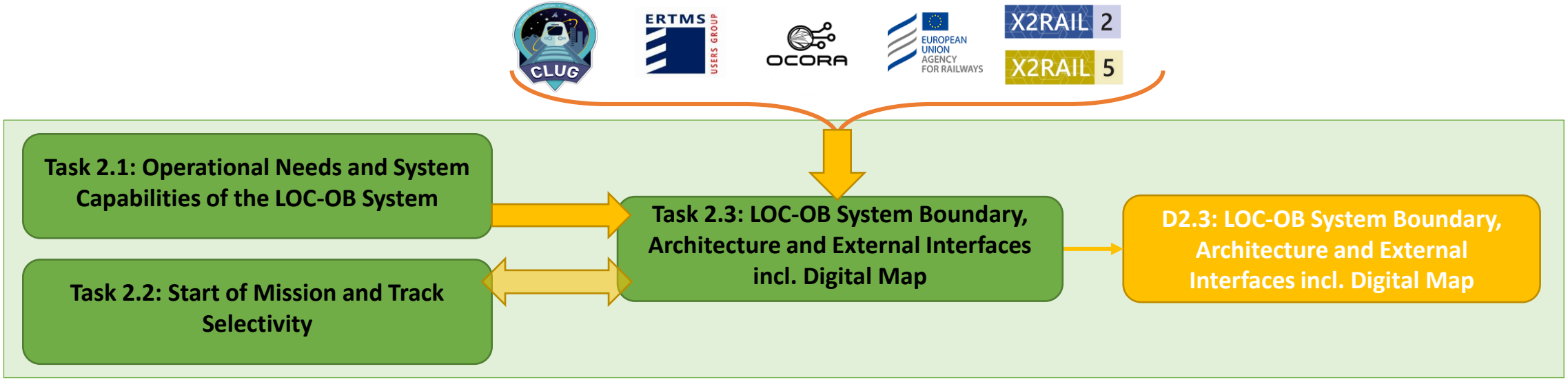
- LOC-OB system-linked operational scenarios analysis relating to Start of Mission and track selectivity.
- Refinement of the operational scenario for Start of Mission. All possible different starting conditions need to be considered, including Start of Mission after change of direction, Start of Mission after Cold Movement, Challenging environment including tunnels, etc.
- Definition of operational scenarios of localisation with respect to track selectivity including movements passing points, localization of non-moving vehicles spanning points with their safe extent, etc.
- Relevant non-functional requirements w.r.t Start of Mission and track selectivity e.g., maximum initialisation duration, speed-specific accuracy requirements, etc are collected from IMs.
- Assessment of potential exported constrains on operations by absolute safe train positioning and description of preliminary acceptance criteria.



Task 2.3: Loc-ob system boundary, architecture and external interfaces incl. digital map

Define the preliminary LOC-OB system architecture aimed to ensure interoperability, interchangeability, and upgradability of a future commercial system including:

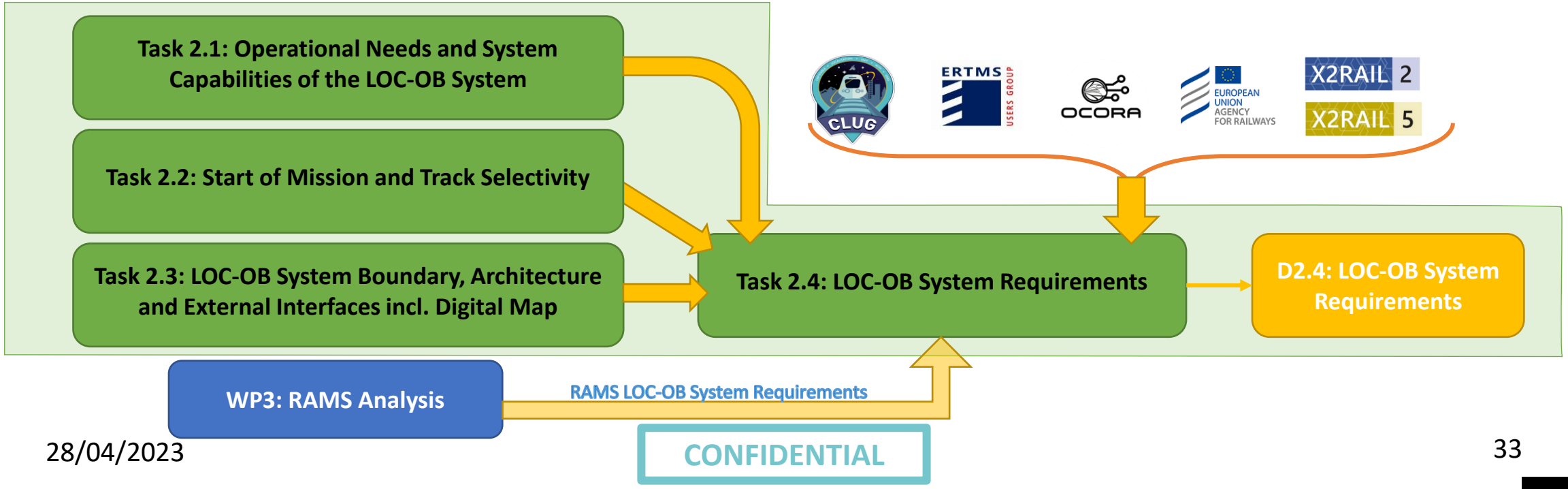
- Analysis of existing system architectures from CLUG, RCA, OCORA, UNISIG and EUG-LWG.
- Definition of constrains, system boundary and operational context.
- System architecture, system functions and external interfaces including digital maps.



Task 2.4: loc-ob system requirement analysis and specification

Specify the preliminary set of requirements to be fulfilled by LOC-OB system to meet the needs of the railway system including:

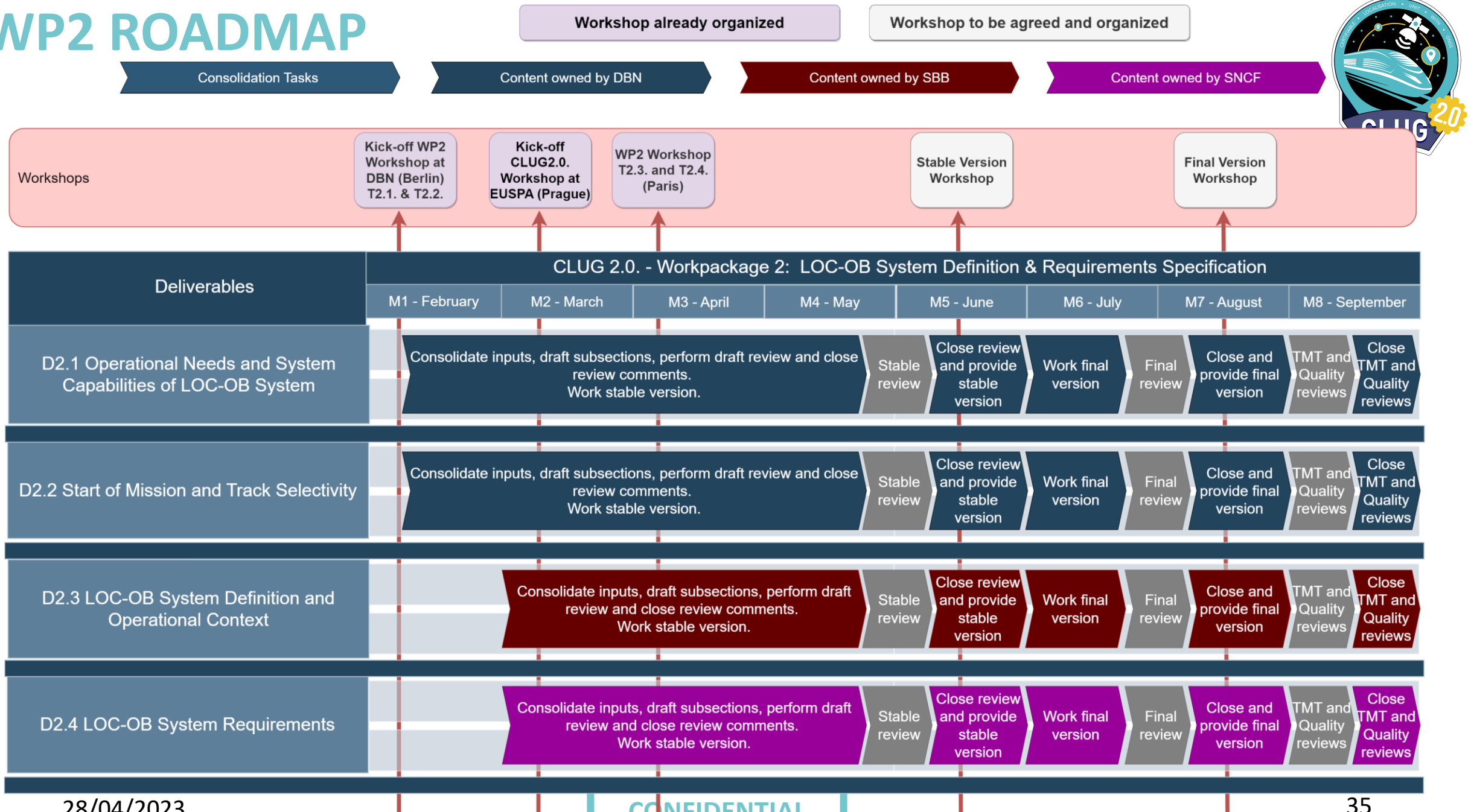
- Analysis of existing system requirements defined in CLUG, RCA, OCORA, UNISIG and EUG-LWG.
- Definition of operational and functional requirements.
- Definition of non-functional requirements including performance requirements but excluding all RAMS requirements (to be specified as part of WP3 deliverables).



CONFIDENTIAL

WP2 - Workplan

WP2 ROADMAP



WP2 – Risk Analysis

Risk Analysis for WP2

ID	Risk Description	WP involved	Mitigation Action Plan or Specific Comments	Probability	Impact	Risk Level
R3	Migration issues betwen ERTMS standards, and migration issues from national standards to ERTMS	WP2, WP6	Strong involvement of the three operators in the standardization process of ERTMS through the ERTMS User Group and SHIFT2RAIL/ERJU standardization process. Regular alignment meetings. Implementation of recommendations from ERJU's System Pillar	LOW	MEDIUM	MEDIUM
R16	Missing input information in documentation Incomplete documents Non sufficient document	WP2	Review of preliminary CLUG1 and EUG documents to identify missing information. WP Detailed description alignment - Partners must be explicit with expected content	LOW	HIGH	MEDIUM
R17	R2DATO WP21 duplication of work with CLUG2 WP2	WP2	A clear work plan has been defined to avoid double funding: the preliminary work is done in CLUG 2.0 with proposals of content for the deliverables proposed to the R2DATO consortium as basis for discussion. R2DATO consortium will then review, comment and agree on the R2DATO deliverable content independently of CLUG 2.0.	Very LOW	HIGH	MEDIUM

ANY QUESTIONS ?

Berta Vallés – WP2 Leader

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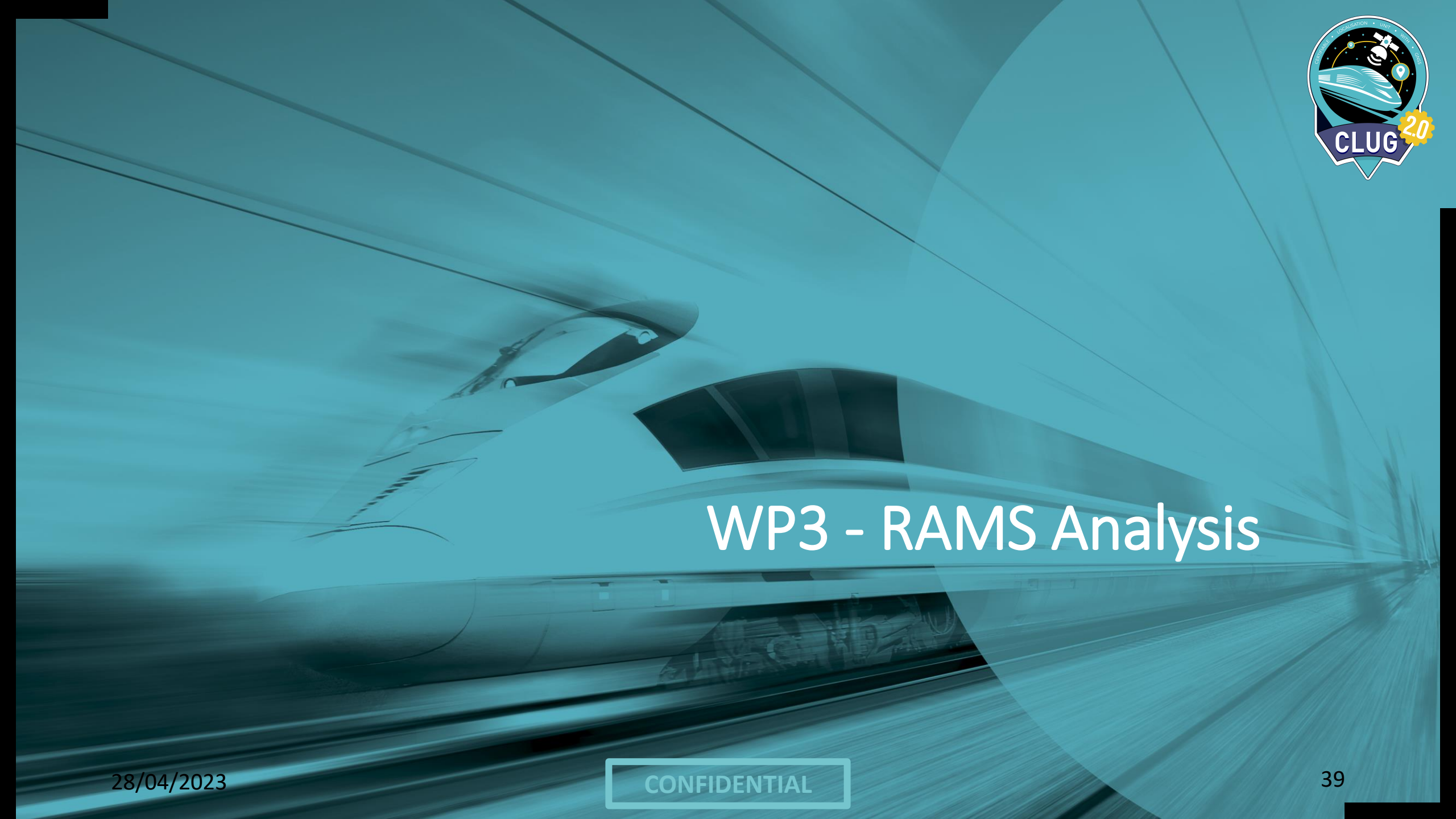
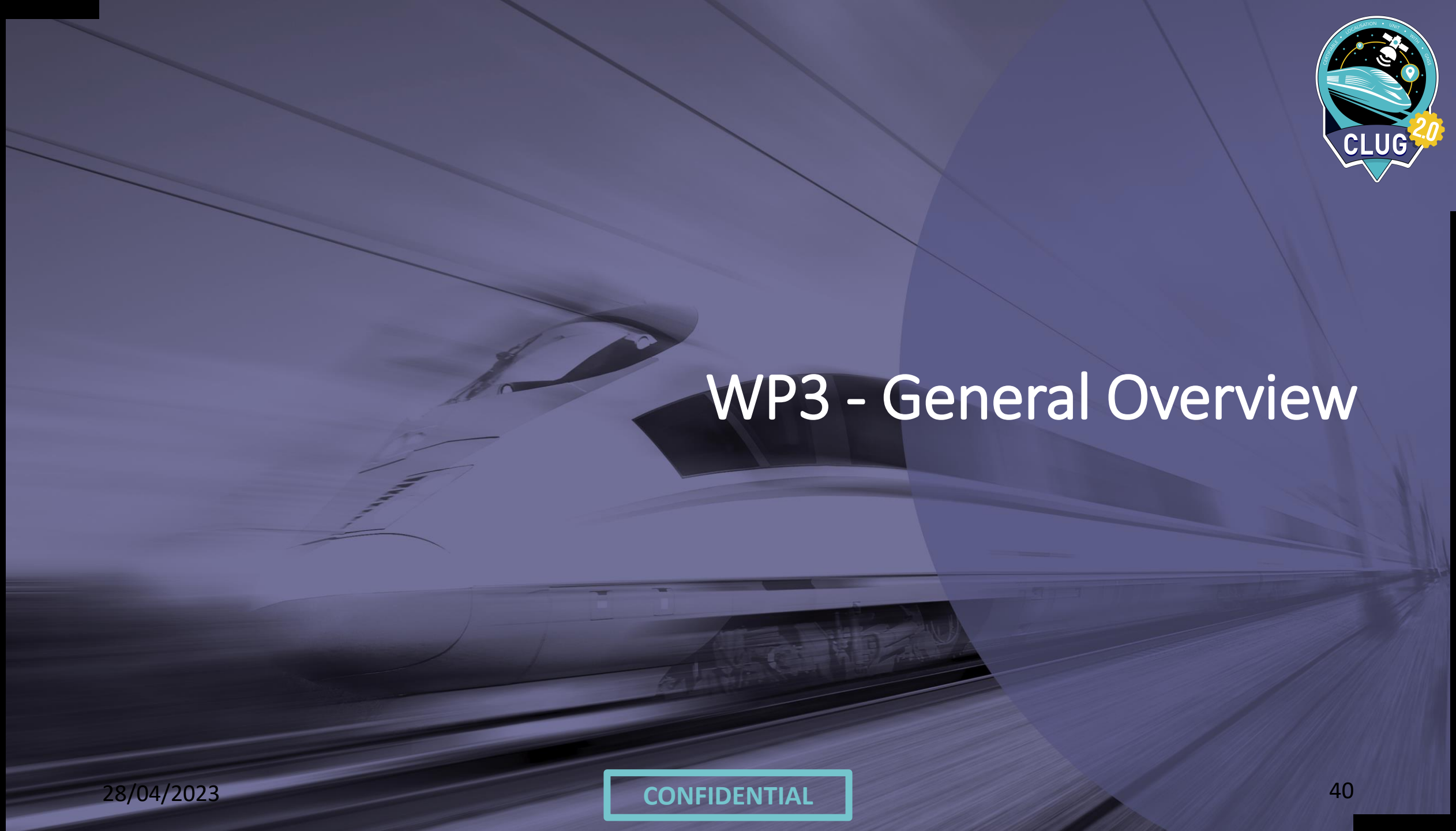
CLIUG 2.0 has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101082624



WP3 - RAMS Analysis



WP3 - General Overview

WP3 OBJECTIVES

To specify RAMS requirements and to demonstrate the safety targets for the CLUG LOC-OB, with respect to Common Safety Methods and CENELEC standards

- To specify the Reliability, Availability, Maintainability and Safety (RAMS) requirements in line with the overall SIL criteria of a railway embedded system to obtain a certifiable CLUG Localisation On-Board (LOC-OB) System
- To demonstrate that the CLUG LOC-OB functional system architecture and interfaces are in line with the specified safety targets
- To consolidate the remaining work to be performed to obtain a certifiable localisation unit in the future

WP3 IN A NUTSHELL

Budget: **28 person.months**
10% of the total CLUG2 budget: 289.4mm)

Participants

Participants	Person months per participant	Subco
SNCF	15	100k€
SMO	4	-
CAF	2	-
DBN	5	-
AIRBUS	2	-

T3.x Leaders: **SNCF, DB, SMO**

Duration: **24 months**

WP3 ROLE OF PARTNERS

Objectives

Specify RAMS requirements and to demonstrate the **safety targets** for the CLUG LOC-OB.

Task contributors	Leader	Contributor	Reviewer
LOC-OB System context analysis and RAMS Plan	SNCF		DB AIRBUS CAF SIEMENS
LOC-OB Preliminary Hazard Analysis context analysis and RAMS Plan	SNCF	AIRBUS	DB CAF SIEMENS
LOC-OB System Failure Modes and Effects Analysis	SNCF		DB CAF SIEMENS
LOC-OB External Interface Safety Analysis	SNCF		DB CAF SIEMENS
LOC-OB System Functional Safety Analysis	DB		CAF SIEMENS AIRBUS SNCF
LOC-OB Reliability Availability Maintainability System Analysis	SIEMENS		SNCF CAF DB
LOC-OB RAMS Evaluation report	SNCF		DB AIRBUS CAF SIEMENS

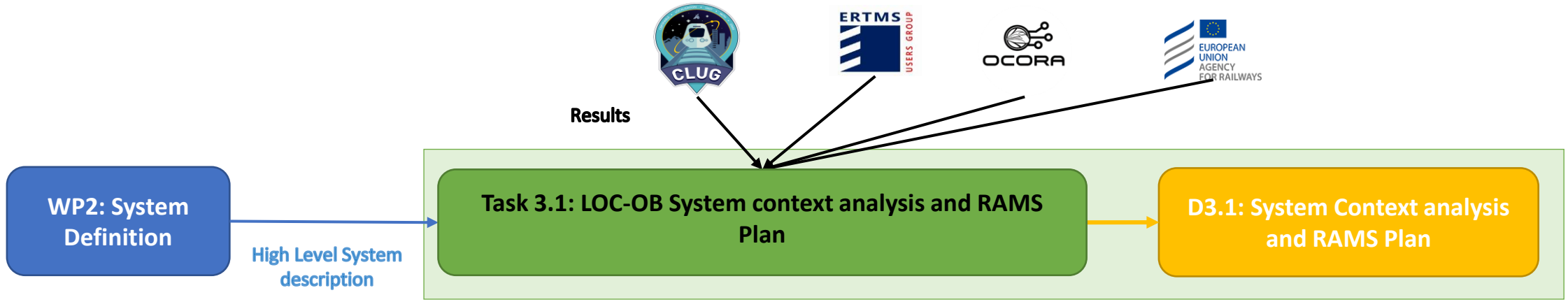
WP3 - Description

Task 3.1: System context analysis and RAMS Plan

To define and coordinate the RAMS objectives and activities for the LOC-OB system

- To define the scope of the LOC-OB system and its RAMS operational and environmental context based on the descriptions provided by the WP2 :
  - the target engines on which the LOC-OB system will be embedded
  - the surrounded systems (for example an EVC as in an OCORA architecture) will be identified.
- To define the RAMS objectives to obtain a certifiable system
- To plan the RAMS activities to follow in the Task 3.2 to Task 3.7.
- To allow to the WP3 leader to manage the WP and coordinate the RAMS activities

M1 – M10

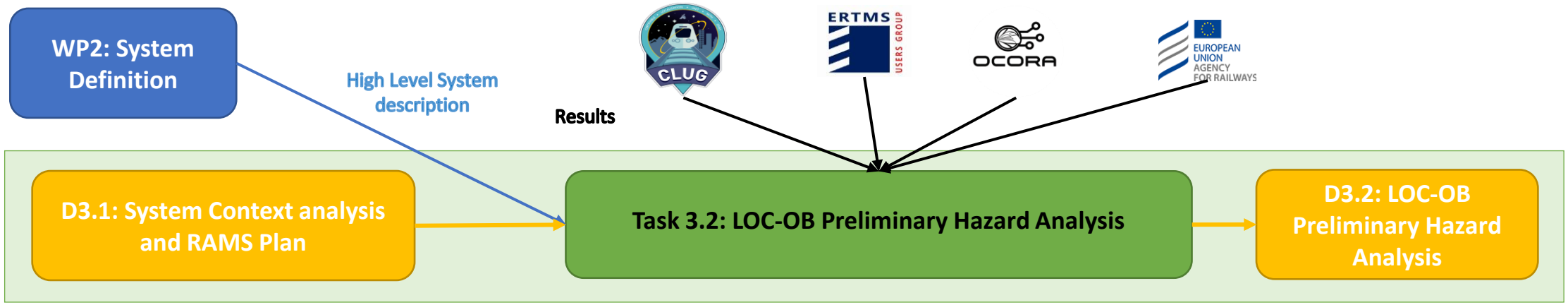


Task 3.2: Preliminary Hazard Analysis

To perform the high-level RAMS analysis

- To identify the hazard
- To assess the severity of the potential accidents that could occur
- To identify safeguards for reducing the risks associated with the hazards
- To identify a list of safety requirements on the system (from an external viewpoint)
- **WS1:** Listing hazards feared events, classify them, identifying risk reductions

M3 – M10

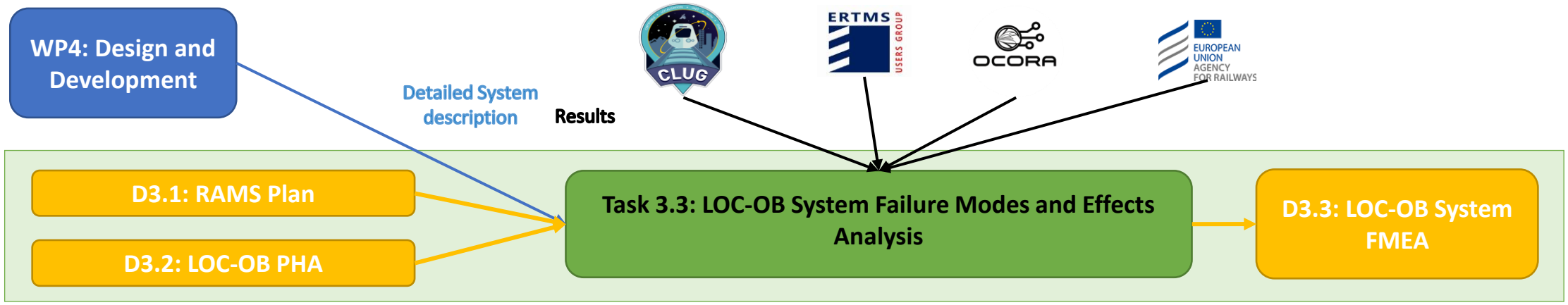


Task 3.3: System FMEA

To provide a Failure Modes and Effects Analysis on the LOC-OB system

- To identify the hazard on each components of the system
- To identify safeguards on each components of the system
- To complete the PHA with a view of the inside of the LOC-OB system
- To identify a list of safety requirements on the system (from an internal viewpoint)
- **WS2 (common T3.3, T3.4, T3.5) :** Conclusions of PHA and consequences on System Analysis. Perimeter and coherence of WP3.2 documents

M11 – M16

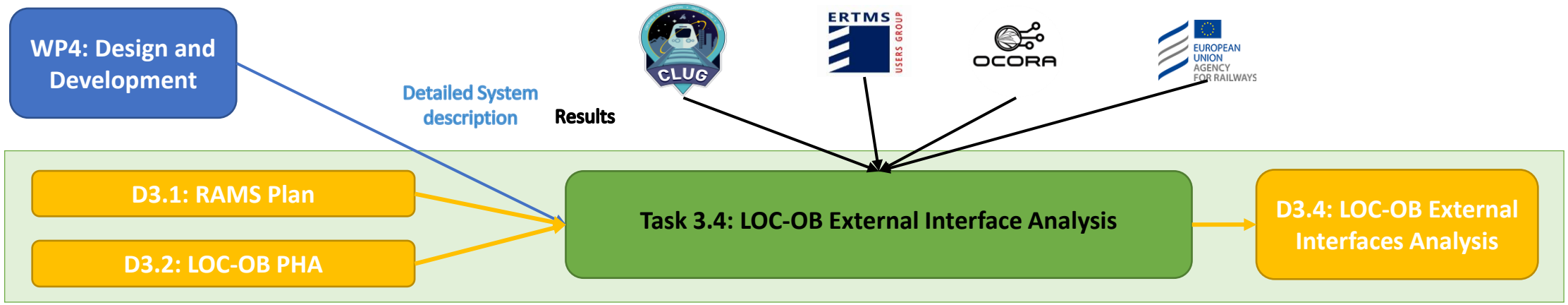


Task 3.4: External Interface Analysis

To provide a detailed safety analysis on the external interfaces of the system

- To identify how the data are exchanged with the external actors
- To focus to the interoperability requirements linked to an onboard architecture on OCORA
- To identify a list of safety requirements on the system (from an interface viewpoint)
- **WS2 (common T3.3, T3.4, T3.5) :** Conclusions of PHA and consequences on System Analysis. Perimeter and coherence of WP3.2 documents

M9 – M14

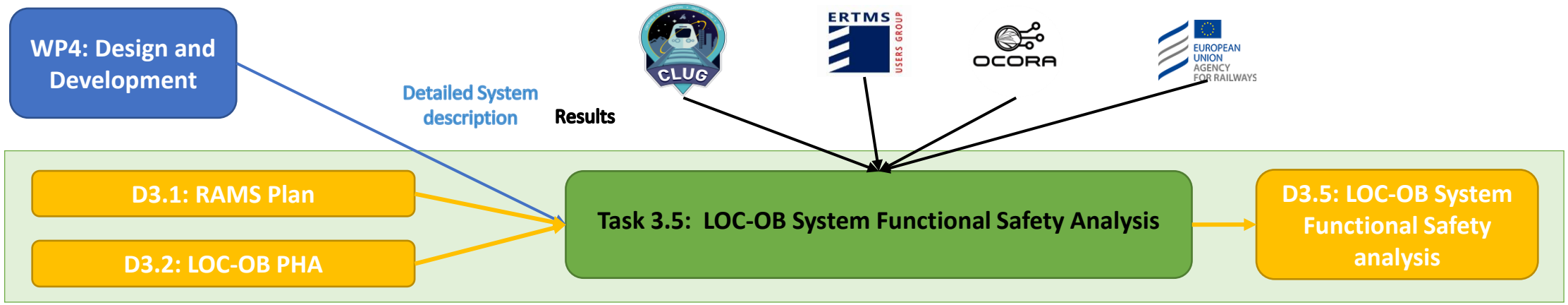


Task 3.5: System Functional SAFETY Analysis

To provide a detailed safety analysis on complex function

- To focus on Start of Mission function
- To focus on Track Selectivity function
- To identify a list of safety requirements on the system (related to the functions analysed)
- **WS2 (common T3.3, T3.4, T3.5) :** Conclusions of PHA and consequences on System Analysis. Perimeter and coherence of WP3.2 documents

M11 – M16

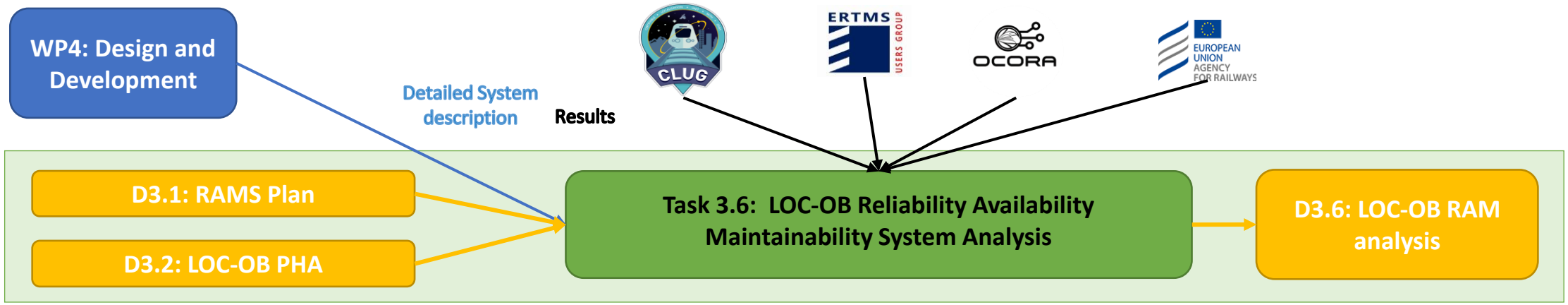


Task 3.6: RAM Analysis

To provide a RAM analysis of the LOC-OB system

- To provide a top-down analysis to allocate the RAM targets defined in D3.1 RAMS plan
- To analyze the different solutions of architecture
- **WS3 :** reliability and availability analysis

M11 – M16

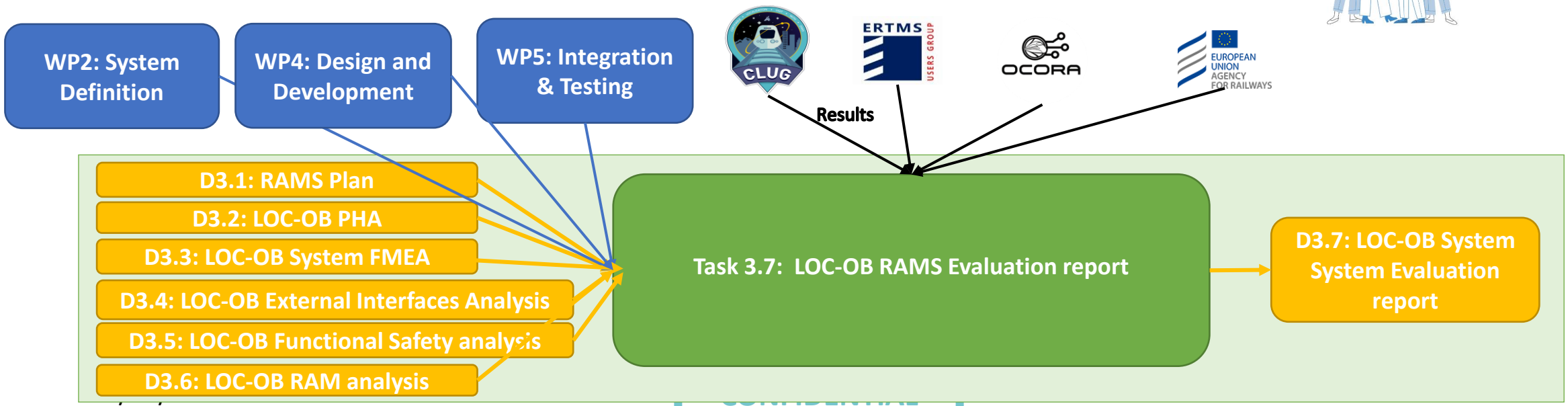


Task 3.7: RAMS Evaluation Report

To evaluate what has been produced during the project

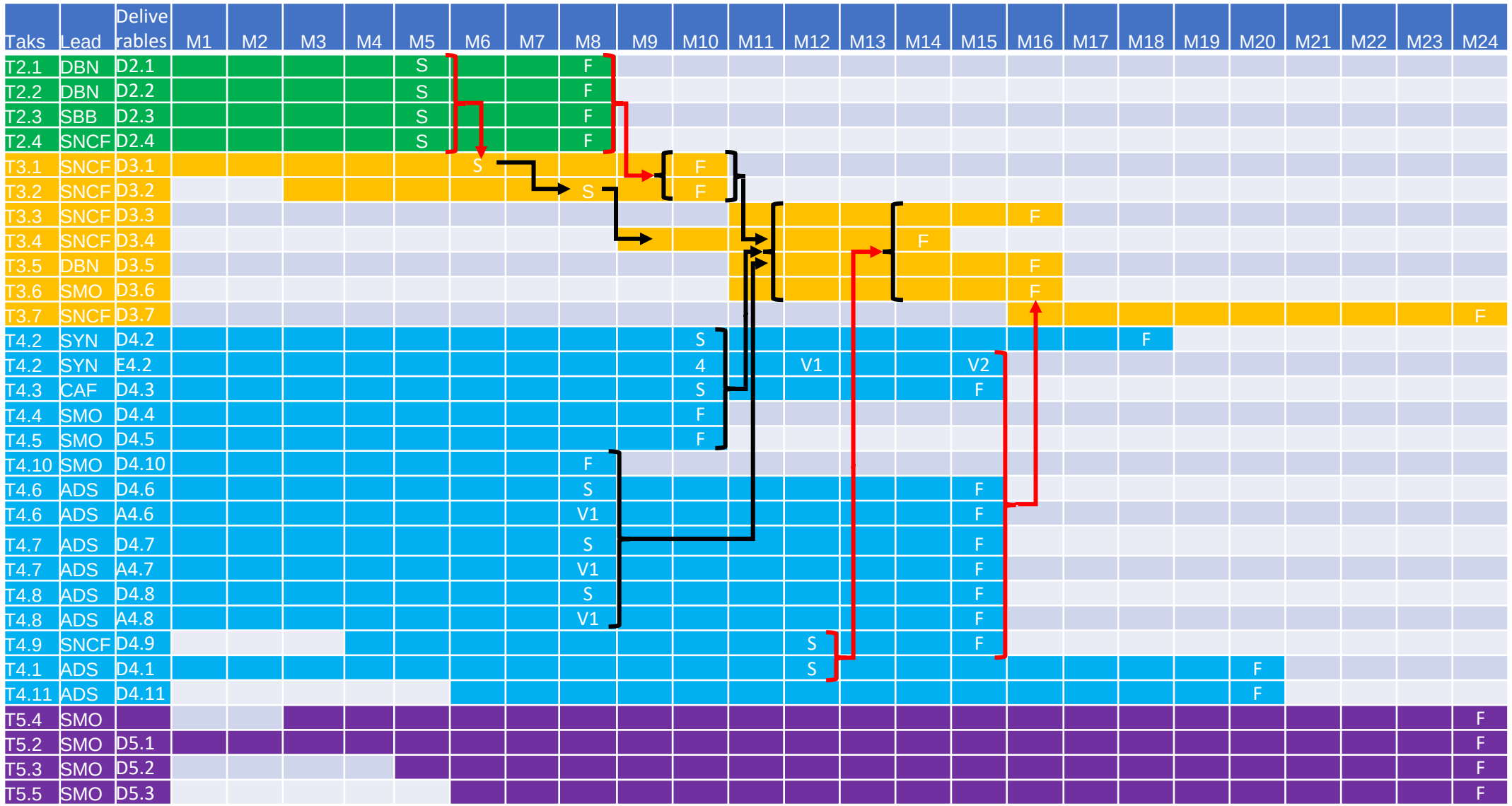
- To evaluate what has been produced during the project to cover the RAMS
- To consider Safety and RAM results defined in Task 3.2 to Task 3.6
- To provide a synthesis of RAMS requirements
- To identified the remaining effort to obtain an authorization agreement
- **WS4 :** meeting with WP Leaders to define the content of the document (Main issues of others WP). Presenting the conclusions of Safety remaining efforts.

M16 – M24



WP3 - Planning and Interdependencies

WP3 DEPENDENCIES



WP3 - Risks

Risk Analysis for WP3

Risk Description	WP involved	Probability	Impact	Risk Level
 Impossibility for all partners to agree on the scope of LOC OB system and on RAMS objectives	WP2, WP3	Low	Medium	Medium

ANY QUESTIONS ?

Marc Sarrat – WP3 Leader

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WP4 - Design & Development

WP4 IN A NUTSHELL

Budget: **84.2 person.months**
30% of the total CLUG2 budget: 289.4mm)

Participants	Person months per participant
ADS	30.9
ENAC	21.2
SYNTONY	13.7
SMO	8
SNCF	3.4
CAF	3
DBN	2.8
SBB	1.2

T4.x Leaders: **ADS, CAF, SYN, SMO, SNCF**

Duration: **24 months**

Participants

AIRBUS

ENAC

SYNTONY GNSS

SNCF SIEMENS

DB CAF

SBB CFF FFS

WP4 OBJECTIVES

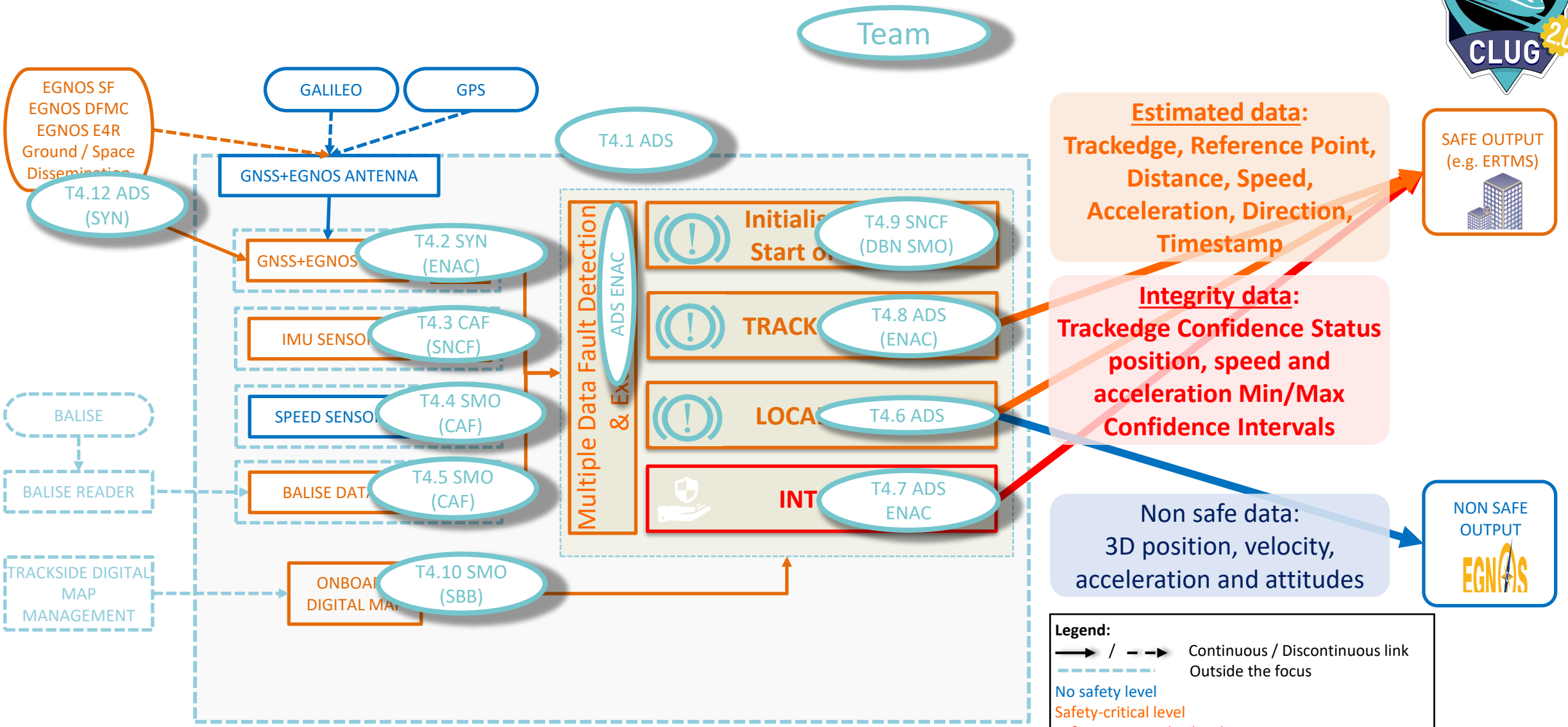
Objectives

Design and development activities of the **functional architecture** of LOC-OB targeting the WP2 requirements.

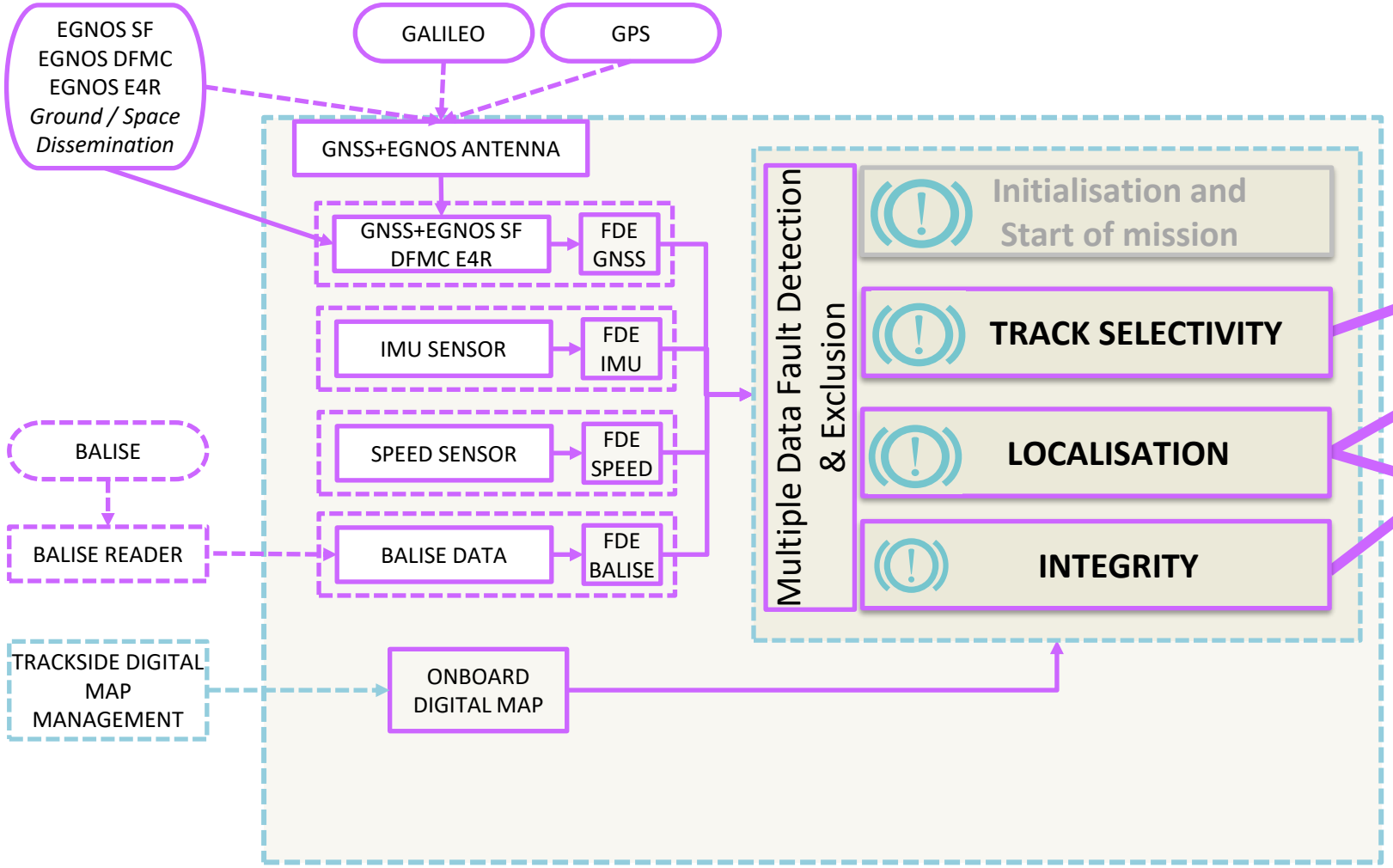
It’s structured in :

- **LOC-OB system and functions refined functional architecture**
- **LOC-OB critical Functions prototypes** for design demonstrations: **implementation of data FDE, track selectivity, Confidence status and Intervals computation,** Along Track position and speed small upgrade
- **LOC-OB safety performance analysis** by engineering simulation: integrity availability assessment to provide compliant output data in accuracy and within the integrity level (SIL).
- **EGNOS services data generation** to enable prototyping tests in WP5.

WP4 FUNCTIONAL ARCHITECTURE & LEADERS



WP4 CLUG2.0 TARGETED MATURITY → POST PROC



Estimated data:
Trackedge, Reference Point, Distance, Speed, Acceleration, Direction, Timestamp

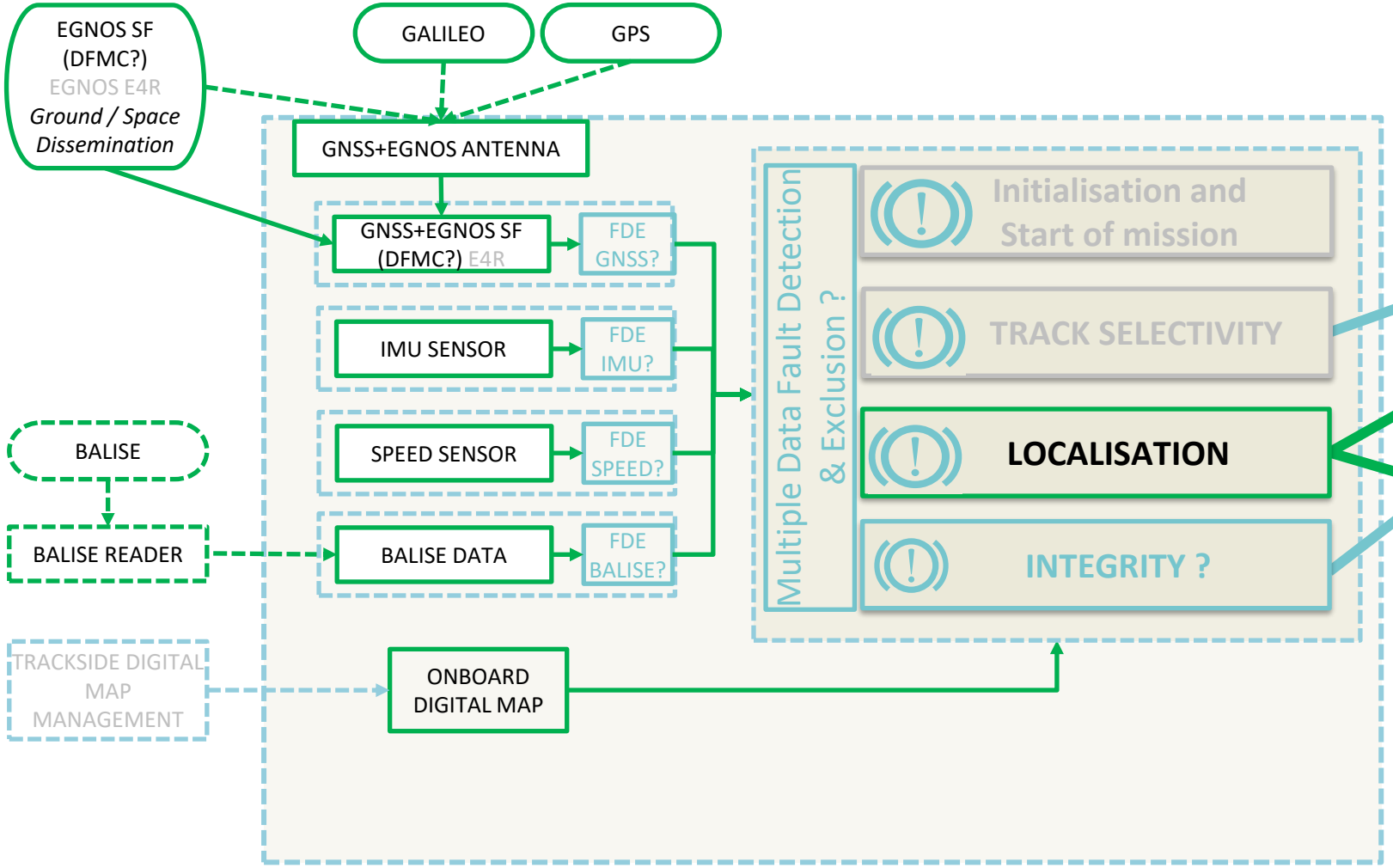
Integrity data:
Trackedge Confidence Status position, speed and acceleration Min/Max Confidence Intervals

Non safe data:
3D position, velocity, acceleration and attitudes

SAFE OUTPUT (e.g. ERTMS)

NON SAFE OUTPUT

WP4 CLUG2.0 TARGETED MATURITY → LIVE



Estimated data:
Trackedge, **Reference Point, Distance, Speed, Acceleration, Direction, Timestamp**

Integrity data:
Trackedge Confidence Status
position, speed and acceleration Min/Max Confidence Intervals

Non safe data:
3D position, velocity, acceleration and attitudes

SAFE OUTPUT
(e.g. ERTMS)

NON SAFE
OUTPUT

Legend:
Live : Live demo
? : maybe added in live demo

WP4 TASKS AND DELIVERIES

Tasks	Task name	Lead	Contributors	Id	Deliverable name	Dissemination level	Delivery date
T4.1	LOC-OB functional architecture	ADS	SMO	D4.1	LOC-OB functional architecture document	SEN	M20
T4.2	GNSS+EGNOS unit sensor including data FDE	SYN	ENAC	I4.2	GNSS+EGNOS unit HW & SW Interface ICD	internal	M10
				E4.2	GNSS+EGNOS unit prototype SW	internal	M15
				D4.2	GNSS+EGNOS unit prototype including data FDE for LOC-OB design and description document	SEN	M18
T4.3	IMU sensor and data FDE	CAF	SNCF	D4.3	Safe IMU sensor and data FDE for LOC-OB description document	SEN	M15
T4.4	Speed sensor (tacho or eq.) and data FDE	SMO	CAF	D4.4	Speed sensor and data FDE for LOC-OB description document	SEN	M10
T4.5	Eurobalise reader sensor and data FDE	SMO	CAF	D4.5	Eurobalise reader sensor and data FDE for LOC-OB description document	SEN	M10
T4.6	Along track localization algorithm robustification	ADS	ENAC, SNCF	A4.6	ADS Along track fusion algorithm SW	internal	M15
				D4.6	Along track localization fusion algorithm design document	SEN	M15
T4.7	Confidence Intervals computation & Integrity algorithm	ADS	ENAC	A4.7	ADS Confidence Intervals computation & Integrity algo SW	internal	M15
				D4.7	Confidence Intervals computation & Integrity algorithm design document	SEN	M15
T4.8	Track Selectivity algorithm	ADS	ENAC, SNCF	A4.8	ADS Track Determination algo SW	internal	M15
				D4.8	Track Selectivity Determination algorithm design document	SEN	M15
T4.9	Start of Mission preliminary definition	SNCF	DBN, SMO, ADS, SYN	D4.9	Start of Mission preliminary design	SEN	M15
T4.10	On board Digital Map Integration	SMO	SBB, ADS	D4.10	On board Digital Map definition and interfaces	SEN	M8
T4.11	CLUG LOC-OB system Performances engineering (Integrity Availability)	ADS	ENAC, DBN, SMO	D4.11	LOC-OB system Performances engineering document	SEN	M20
T4.12	EGNOS data generation made available for tests	ADS	SYN, SMO	Data4.12.1	ADS EGNOS simulated DFMC data	internal	M3-M24
				Data4.12.2	ADS EGNOS simulated E4R data	internal	M9-M24

WP4 DEPENDENCIES

Tasks	Leader	Deliverables	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
T2.1	DBN	D2.1					S			F																
T2.2	DBN	D2.2					S			F																
T2.3	SBB	D2.3					S			F																
T2.4	SNCF	D2.4					S			F																
T3.1	SNCF	D3.1						S				F														
T3.2	SNCF	D3.2								S		F														
T3.5	DBN	D3.5																S						F		
T4.2	SYN	D4.2										S								F						
T4.2	SYN	E4.2			ICD (S)	HW (S)						ICD (F)		V1			V2									
T4.3	CAF	D4.3										S					F									
T4.4	SMO	D4.4										F														
T4.5	SMO	D4.5										F														
T4.10	SMO	D4.10								F																
T4.6	ADS	D4.6								S							F									
T4.6	ADS	A4.6								V1							V2									
T4.7	ADS	D4.7								S							F									
T4.7	ADS	A4.7								V1							V2									
T4.8	ADS	D4.8								S							F									
T4.8	ADS	A4.8								V1							V2									
T4.9	SNCF	D4.9												S			F									
T4.1	ADS	D4.1												S								F				
T4.11	ADS	D4.11																				F				
T4.12	ADS	D(a)4.12			DFMC						E4R															
T4.12	ADS	D(a)4.12																								
T5.4	SMO																									
T5.2	SMO	D5.1																	S							F

Risk Analysis for WP4

ID	Risk Description	WP involved	Mitigation Action Plan or Specific Comments	Probability	Impact	Risk Level
R13	Delays in the provision of equipment and software pieces for the live (near real time) demonstration in WP5	WP4, WP5	Consortium commitment for the live demo is securely set to the along track functionality only, using existing sensors + GNSS+EGNOS data unit + the ADS Along track algorithm already prototyped in post processing during CLUG1. Note: digital map will include only the track on which the train will be on scheduled track.	Very LOW	MEDIUM	LOW
R15	Missing sensor data FDEs prototypes for the sensors.	WP4, WP5	The WP4 fusion and integrity algorithms can run even if there is a missing sensor data FDE. Global FDE will also be made at fusion filter level to remove potential faulty measurements. The WP5 SMO platform is designed to enable experimentation even without some missing functions such as sensor data FDE	LOW	LOW	LOW

ANY QUESTIONS ?

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CLIUG 2.0 has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101082624

WP5 - Integration & Testing (including Site Demonstrator)

WP5 in a nutshell

Budget: **64.4 person-months**
22% of the total CLUG2 budget: 289.4mm)

Participants	Person months per participant
SMO	35
SBB	6
ADS	5.4
CAF	4
SNCF	3.5
DBN	3.5
SYN	3
ENAC	3

T5.x Leaders: **SMO**

Duration: **24 months**

Participants

SIEMENS

SBB CFF FFS

AIRBUS CAF

SNCF DB

SYNTONY GNSS ENAC

WP5 Objectives

Objective

Design and develop tools and an onboard demonstrator to **analyse and improve the performance of the CLUG positioning solution.**

It's structured in :

- **Raw Data Collection System:** development and installation of a system to collect field data from all sensors for the offline simulation of the CLUG solution, including and automated collection of map and route data
- **Onboard Site Demonstrator:** development and installation of a hard- and software to test a partial implementation of the CLUG solution live on a train
- **Data Collection and Life Demonstration:** collection and processing of raw data in different environments for the offline simulation and performing life demonstrations of the Onboard Site Demonstrator on a train of SBB
- **Data Post Processing:** generating of speed, position and attitude from the collected raw data using the fusion and fault detection and exclusion algorithms developed in WP4
- **Data Analysis and Interpretation:** analysing the performance of the developed solution and identifying potential improvements

WP5 Roles of Partners

Duration: M1 to M24

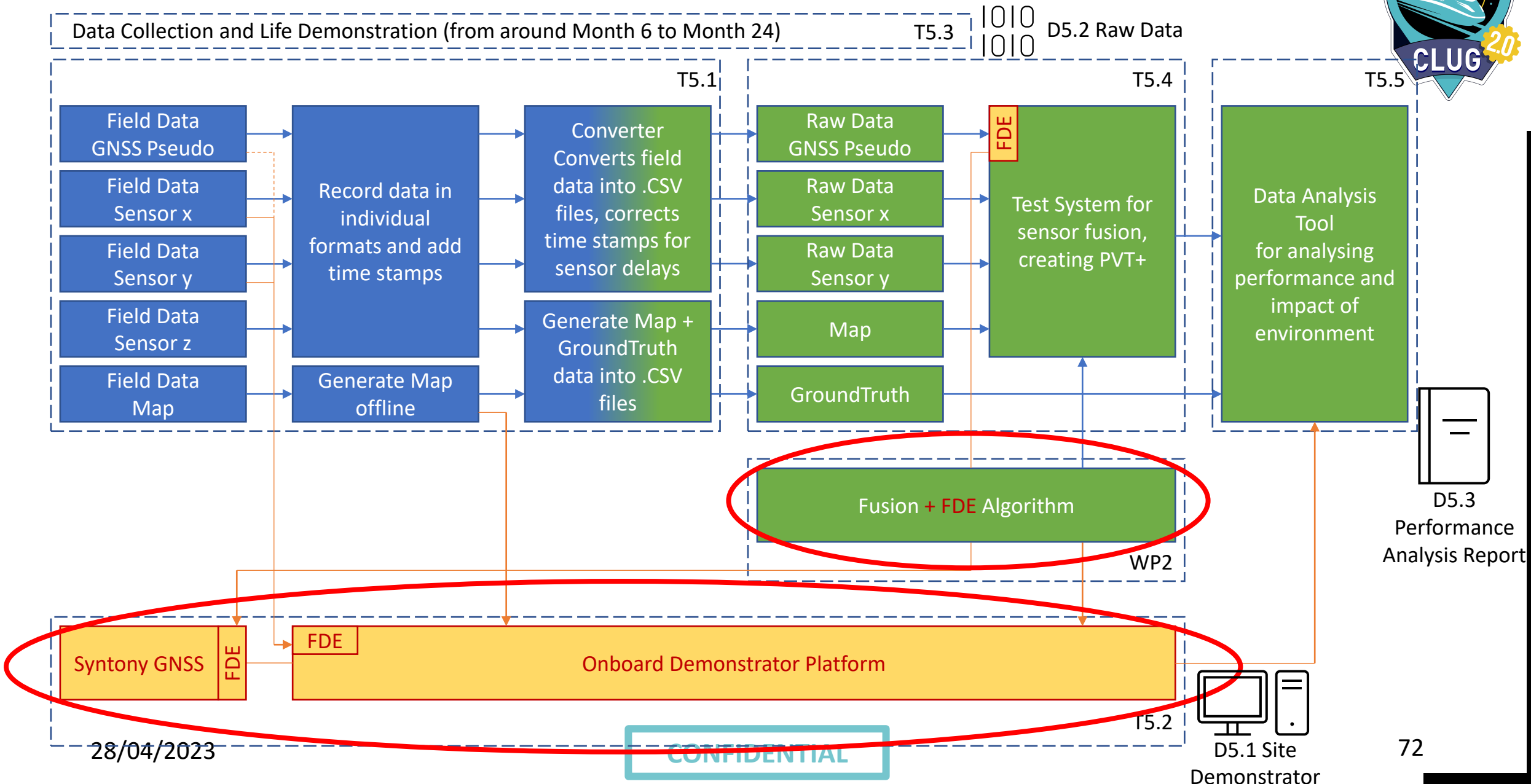
Objectives

Specify RAMS requirements and to demonstrate the **safety targets** for the CLUG LOC-OB.

Task contributors

	Leader	Contributor	Reviewer
Raw Data Collection	SIEMENS	SYNTONY GNSS	SBB CFF FFS
Onboard Site Demonstrator	SIEMENS	SYNTONY GNSS, AIRBUS DEFENCE & SPACE	
Data Collection	SIEMENS	SBB CFF FFS, SNCF	DB, CAF, AIRBUS DEFENCE & SPACE
Data Post Processing	SIEMENS	SBB CFF FFS	SYNTONY GNSS, AIRBUS DEFENCE & SPACE
Data Analysis and Interpretation	SIEMENS	SBB CFF FFS, CAF, SNCF, SYNTONY GNSS, AIRBUS DEFENCE & SPACE, ENAC	

WP5 Basic Workflow Offline / Online



WP5 Deliverables

WP5 produces three deliverables, which differ significantly from each other:

D5.1 Site Demonstrator is produced in Task 5.2, and builds largely on work done in X2R5-WP7. It will also be used as the basis of work done post CLUG 2 in the ERJU Innovation Pillar. The result is a real time life demonstration of the CLUG 2 algorithms, which will be shown onboard a test train.

D5.2 Raw Data is produced in Task 5.1, Task 5.2 and Task 5.4. It builds largely on work done in CLUG, from where the onboard demonstrator is being used, as well as on the CLUG tool chain. Both will however be upgraded significantly, as shown in the subsequent slides. The result will be again Raw data, as well as map and ground truth data for a representative number of trips. This data can then be used in other projects.

D5.3 Performance Analysis Report is produced in Task 5.5, and builds on the output produced Task 5.4, using data collected in Task 5.3. This report will show in detail the performance of the CLUG 2 algorithms, both produced in the offline sensor fusion and online with the demonstrator.

WP5 T5.1 Raw Data Collection

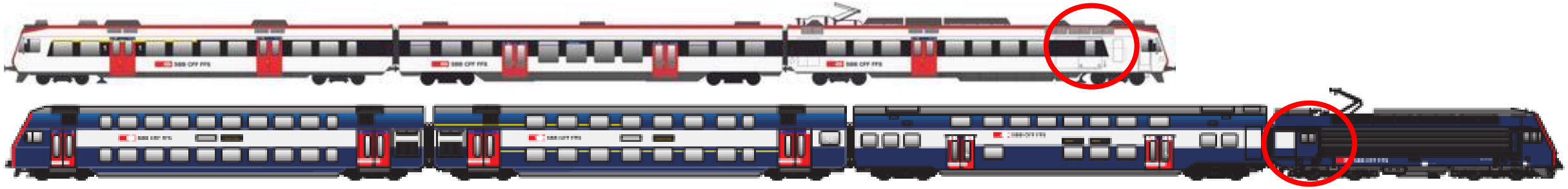
WP5 will continue to collect raw data using the Domino test train from CLUG, as well as a second test train Re450.

All elements of the chain will however be improved, in order to:

Collect data in more challenging environments (especially urban), by equipping a second train which operates in the area of the S-Bahn Zurich, with many tunnels, underground stations etc.

Expand the type of data (specifically attitude and heading), by installing high-grade IMUs on both trains for reference, which are being provided by SBB

Collect and processing data in more automated way, by collecting data on the actual routes taken by the train from the Traffic Management System from SBB



WP5 T5.1 Raw Data Collection

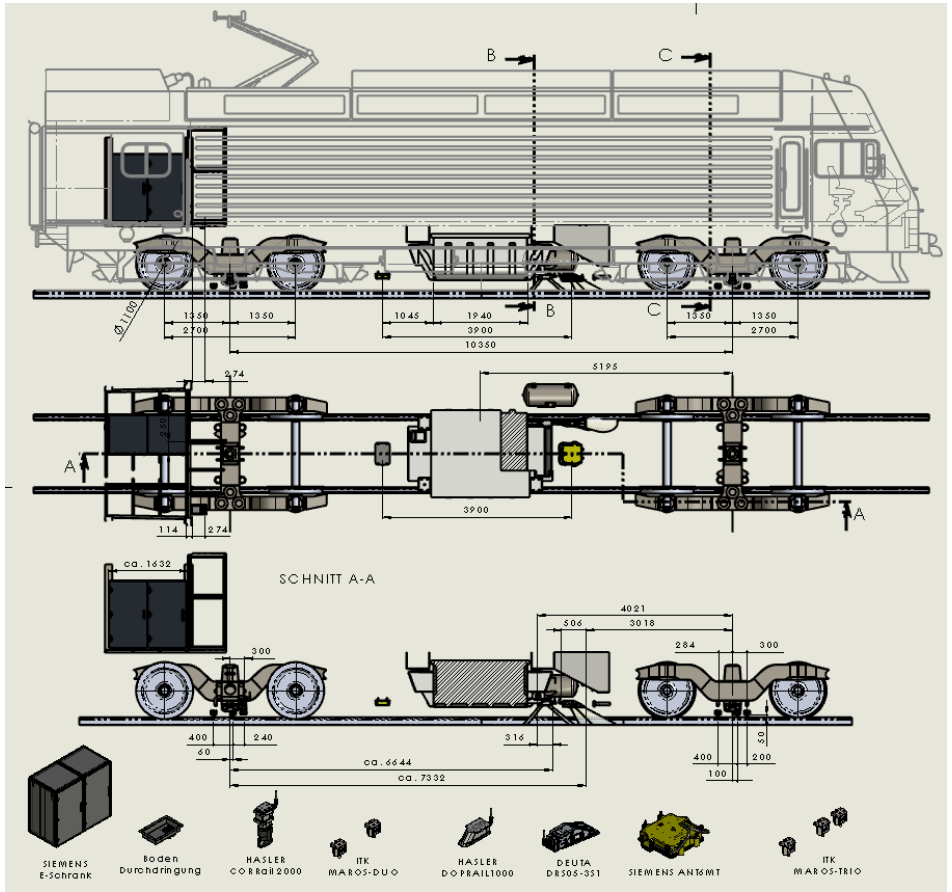
WP5 will continue to collect raw data using the test train from CLUG, as well as a second test train.

Installing the Raw Data Collection System from CLUG on a second train is a significant effort, as time is limited and the train operates in commercial service.

The Re450 is however well suited, as space is available in the baggage compartment as well as underneath the train.

The System on the Re450 is being designed for the additional installation of the life demonstrator, which requires more space, power and the provision of sensor data in parallel to the data recording system and the life demonstrator.

The upgrades to the Data Collection System will also be implemented on the Domino train, to achieve maximum coverage of different environments and to provide a level of redundancy, in case one of the train might be unavailable for some time.



WP5 T5.2 Onboard Site Demonstrator

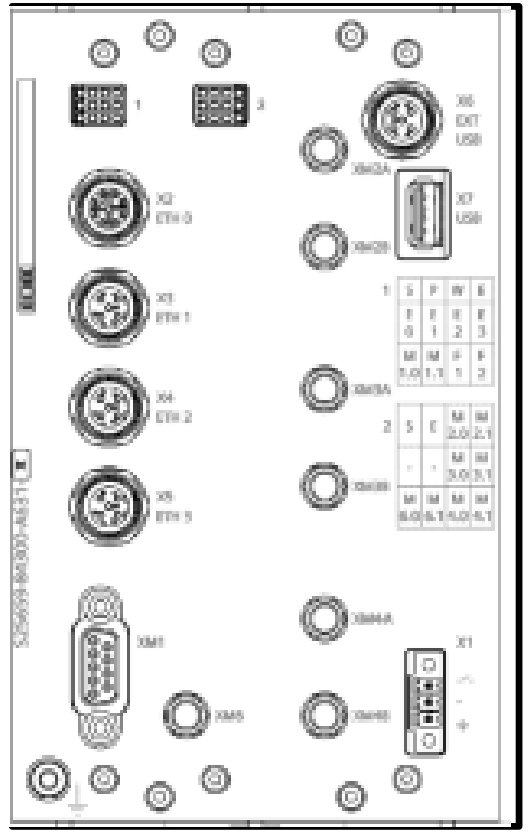
WP5 will also expand the testing of the sensor fusion solution by developing a real time demonstrator, which will be installed and tested on a train in addition to the offline testing.

The Onboard Site Demonstrator is being implemented using a high performance computing module, designed for railway applications, to which the various sensors as well as the balise reader are being connected.

The Track Map provided by SBB will also be included in the onboard site demonstrator. Automated uploading of the map, as well as of map updates will however not yet be possible.

The Onboard Site Demonstrator will be installed on one on the Re450, and it's output recorded by the same system which also collects sensor raw data. Both offline analysis of the performance, as well as live demonstrations are therefore possible.

Data generated in Offline Post Processing can be compared with data from the onboard demonstrator, to verify that the offline processing is generating valid results.



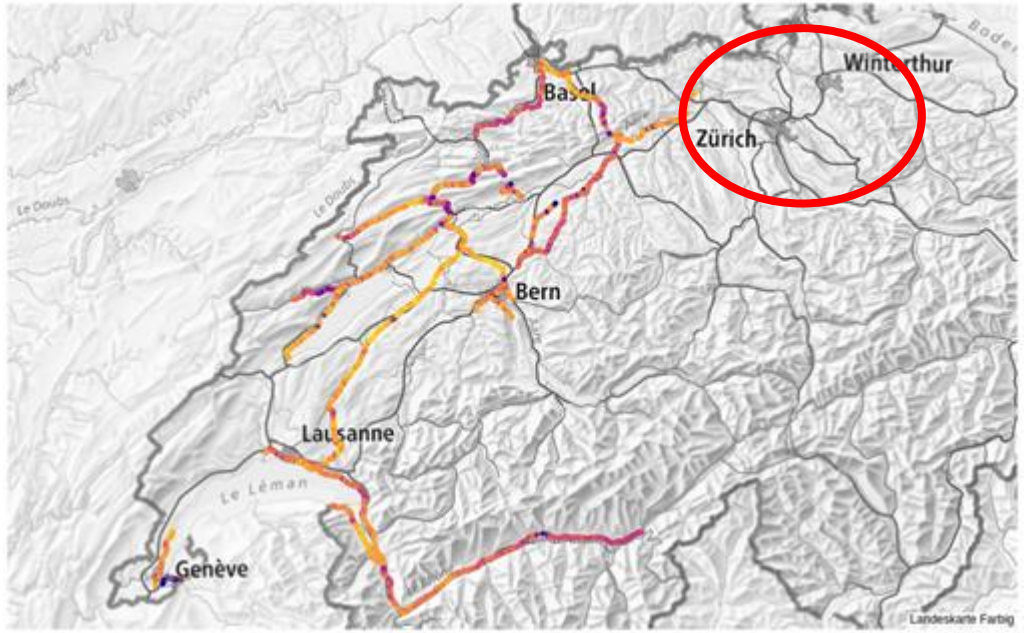
WP5 T5.3 Data Collection

WP5 will also expand the testing by implementing the solution in a real time demonstrator, which will be installed and tested on a train.

With the Domino Train, data has mostly been collected in rural and mountainous areas of Switzerland. This will continue in CLUG 2, as the train continues to operate in the same area.

The Re450 Train, data collection will be extended into much more urban areas, as it operates **on the Zurich S-Bahn network**, which includes the city of Zurich with multiple underground stations and many longer tunnels.

Combined, the two trains will cover most environments which can be expected in Europe, with the exception of high speed lines.



Thanks to the improved automation, the two trains are expected to deliver data over around 10’000 hours and 250’000 km, which will provided a solid basis for detailed, as well as statistical analysis.

WP5 T5.4 Data Post Processing

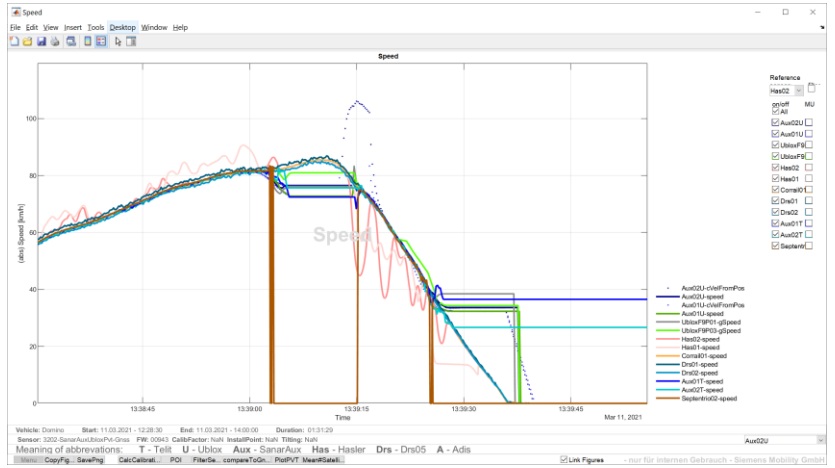
WP5 will also expand the testing by implementing the solution in a real time demonstrator, which will be installed and tested on a train.

The Data Post Processing Tools will be upgraded as well, in order to increase the level of automation. This will permit analysis of the larger amounts of data collected by the two trains.

A Parallel Stream of Mass Data Analysis will also be established, focusing on statistical analysis.

The Ground Truth tool will be updated as well, specifically to provide attitude information. Some level of automation will also be implemented to minimize manual verification.

Finally, some verification will be performed to verify the accuracy of the Ground Truth data.



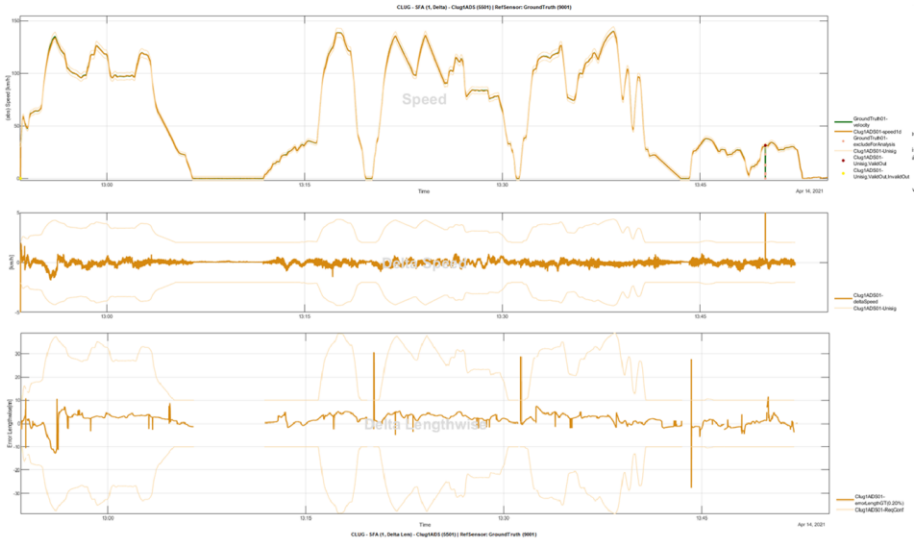
WP5 T5.5 Data Analysis and Interpretation

WP5 will also expand the testing by implementing the solution in a real time demonstrator, which will be installed and tested on a train.

The Raw Data Collection System: update from CLUG, installation on second train in Switzerland and collection of map and route data

Onboard Site Demonstrator: development and installation of the hard and software to be tested on a train

Data Collection and Life Demonstration: collection of raw data in different environments for offline simulation and life demonstration of the Onboard Site Demonstrator on a train of SBB in Switzerland



Data Post Processing to generate speed, position and attitude from the collected raw data using the fusion and fault detection and exclusion algorithms developed in WP4

Data Analysis and Interpretation to determine the performance of the developed solution and to identify potential improvements

WP5 Tasks and Planning

CLUG 2 WP5

		Month	Feb 23	Mär 23	Apr 23	Mai 23	Jun 23	Jul 23	Aug 23	Sep 23	Okt 23	Nov 23	Dez 23	Jan 24	Feb 24	Mär 24	Apr 24	Mai 24	Jun 24	Jul 24	Aug 24	Sep 24	Okt 24	Nov 24	Dez 24	Jan 25
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
5.1	Raw Data Collection System	SMO																								
	Clarification of map data distribution	SMO/SBB																								
	Provision of map data	SBB																								
	Clarification of route data distribution	SMO/SBB																								
	Provision of route data	SBB																								
	Upgrading of NI system	SMO					M																			
	Upgrading of various sensors	SMO					M																			
	Provision of high-grade IMU	SBB																								
	Installation of system on Re450 Train	SBB/SMO						M																		
	Upgrading of system on existing Domino Train	SMO/SBB						M																		
	Updating of ground truth tool	SMO						M																		
	Verification of Map quality	SMO									M															
5.2	Onboard Site Demonstrator	SMO																								
	Provision of demonstrator hardware and basic firmware	SMO						M															F			
	Provision of SDR GNSS receiver specification	SYN			D							F														
	Provision of SDR GNSS receiver	SYN				D								F												
	Provision of sensor fusion algorithm	ADS												D			F									
	Provision of SDR GNSS receiver software with FDE	SYN												D			F									
5.3	Data Collection and Life Demonstration	SMO																								
	Collection of GNSS data	SMO						M																		
	Organisation of life demonstration of demonstrator	SBB, SNCF																								

CLUG 2 WP5

		Month	Feb 23	Mär 23	Apr 23	Mai 23	Jun 23	Jul 23	Aug 23	Sep 23	Okt 23	Nov 23	Dez 23	Jan 24	Feb 24	Mär 24	Apr 24	Mai 24	Jun 24	Jul 24	Aug 24	Sep 24	Okt 24	Nov 24	Dez 24	Jan 25
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
5.3	Data Collection and Life Demonstration	SMO																								
	Collection of GNSS data	SMO						M																		
	Organisation of life demonstration of demonstrator	SBB, SNCF																								
5.4	Data Post Processing	SMO																								
	Update of data conversion tools for addional / upgraded sensors	SMO									M							M								
	Update of data fusion tesbed for offline data fusion	SMO									M							M								
	Provision of fusion algorithm for offline fusion	ADS								D							F									
	Provision of simulated augmentation data for	ADS			D									F												
	Provision of supply simulated augmentation data for E4R	SYN									D						F									
5.5	Data Analysis and Interpretation	SMO																								
	Update of tools																									
	Kickoff with updated tools	SMO										M														
	Data Analysis and Interpretation workshops	SMO																						M		
	Participation in Data Analysis and related workshops	SBB, SNCF, DBN, ENAC, ADS, CAF																								

D Draft F Final M Milestone

WP5 DEPENDENCIES

WP5 also depends on a number of deliveries by other work packages.

The interdependencies of WP5 are largely towards WP4 to deliver:

- sensor fusion algorithms for the offline sensor fusion, as well as the demonstrator from ADS
- delivery of FDC algorithms from Syntony, ENAC and possibly other partners
- delivery of EGNOS simulated DFMC data and AS EGNOS simulated E4R data by ADS

Deliverables	Description	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
D4.2	GNSS+EGNOS unit prototype including data FDE for LOC-OB design and description document	4	4	4	4	4	4	4	4	4	S	4	4	4	4	4	4	4	F						
E4.2	SYN GNSS+SBAS unit Proto	4	4	ICD (S)	HW (S)	4	4	4	4	4	ICD (F)	4	V1	4	4	V2									
D4.3	Safe IMU sensor and data FDE for LOC-OB description document	4	4	4	4	4	4	4	4	4	S	4	4	4	4	F									
D4.4	Speed sensor and data FDE for LOC-OB description document	4	4	4	4	4	4	4	4	4	F														
D4.5	Eurobalise reader sensor and data FDE for LOC-OB description document	4	4	4	4	4	4	4	4	4	F														
D4.10	On board Digital Map definition and interfaces	4	4	4	4	4	4	4	F																
D4.6	Along track localization fusion algorithm design document	4	4	4	4	4	4	4	S	4	4	4	4	4	4	F									
A4.6	ADS Along Track Fusion proto Algo	4	4	4	4	4	4	4	V1	4	4	4	4	4	4	F									
D4.7	CI computation & integrity algo design doc	4	4	4	4	4	4	4	S	4	4	4	4	4	4	F									
A4.7	ADS CI computation & integrity proto algo	4	4	4	4	4	4	4	V1	4	4	4	4	4	4	F									
D4.8	Track Selectivity Determination Algorithm design doc	4	4	4	4	4	4	4	S	4	4	4	4	4	4	F									
A4.8	ADS Track determination proto Algo	4	4	4	4	4	4	4	V1	4	4	4	4	4	4	F									
D4.9	Start of Mission preliminary design				4	4	4	4	4	4	4	4	S	4	4	F									
D4.1	LOC-OB Functional architecture doc	4	4	4	4	4	4	4	4	4	4	4	S	4	4	4	4	4	4	4	F				
D4.11	LOC-OB Syst Performances engineering doc						4	4	4	4	4	4	4	4	4	4	4	4	4	4	F				
D(a)4.12	ADS EGNOS simulated DFMC data			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
D(a)4.12	ADS EGNOS simulated E4R data									4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Data Post Processing			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
D5.1	Site Demonstrator	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	S	5	5	5	5	5	5	F
D(a)5.2	Raw Data					5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	F
D5.3	Perfo Analysis Report						5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	F

Risk Analysis for WP4

Id	Risk Description	WP involved	Mitigation Action Plan or Specific Comments	Probability	Impact	Risk Level
R4	Approvals of on-board installations consistent with the general schedule	WP5	Design of installation with minimum impact on train, early involvement of approval bodies.	Very LOW	HIGH	MEDIUM
R5	Unavailability of suitable trains for testing according to schedule	WP5	Domino test train unavailability: 2 maintenances will have to be planned during the CLUG 2.0 project. A second train will be equipped with the same sensors during the course of the project to mitigate this problem. Use of commercial and test train (dedicated or not). (Linked to R8, R9, R10, R11, R16, R17).	LOW	HIGH	MEDIUM
R6	Material procuration delays	WP5	Difficulty to procure material as most suppliers can't confirm delivery dates. No mitigation possible.	MEDIUM	HIGH	MEDIUM
R14	Live demonstration failure due to operational constraints (change of planned track routes)	WP5, WP6	Secure track routes before operations. Schedule extra test trips.	MEDIUM	LOW	MEDIUM

ANY QUESTIONS ?

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WP6 - Dissemination + Standardization and Business Case

WP6: Communication, Dissemination, Exploitation and Business Case

Objectives

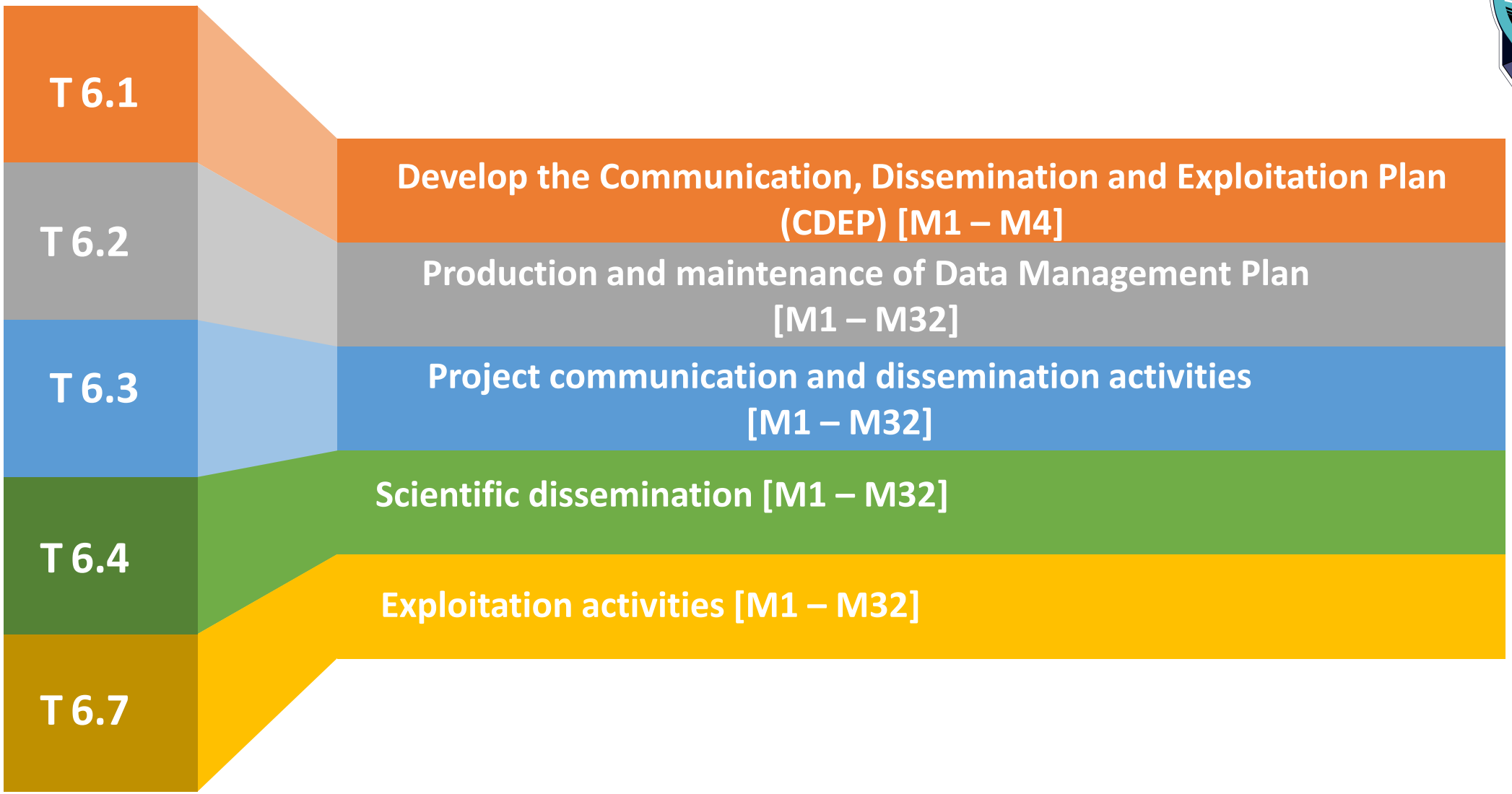
Ensure that the project results and outputs are disseminated widely and effectively exploited by their target groups (including EUSPA).

Task contributors

	Leader	Contributor	Reviewer
Business case for GNSS based absolute safe train positioning	DB	SNCF, SIEMENS, CAF	SYNTONY GNSS, AIRBUS
Definition of modular and interoperable LOC-OB System for **future standardisation**	DB	SNCF, SIEMENS, CAF	SYNTONY GNSS, AIRBUS

Duration: M1 to M24

DISSEMINATION AND EXPLOITATION TASKS

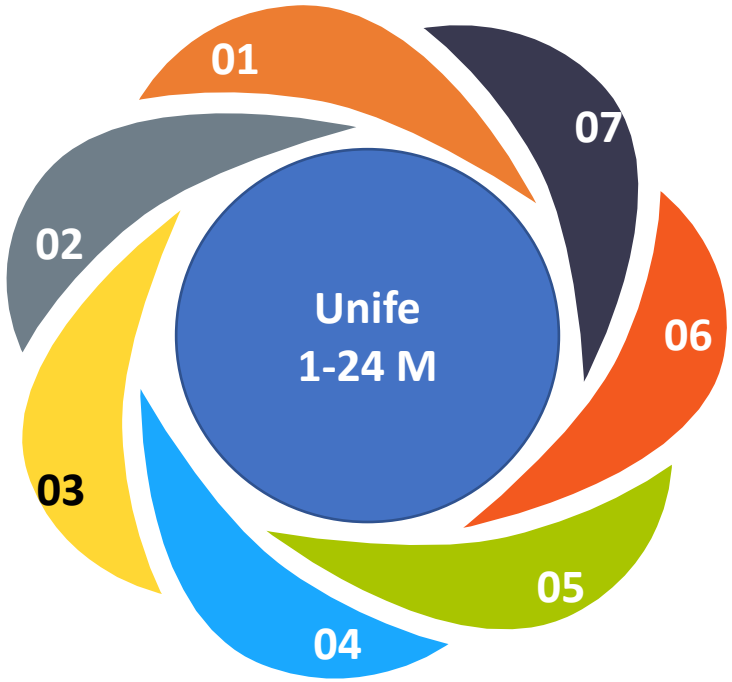


T6.3 and T6.4 communication and dissemination

Project Identity Set (M1)

Public Website (M3)

Brochure (M4)



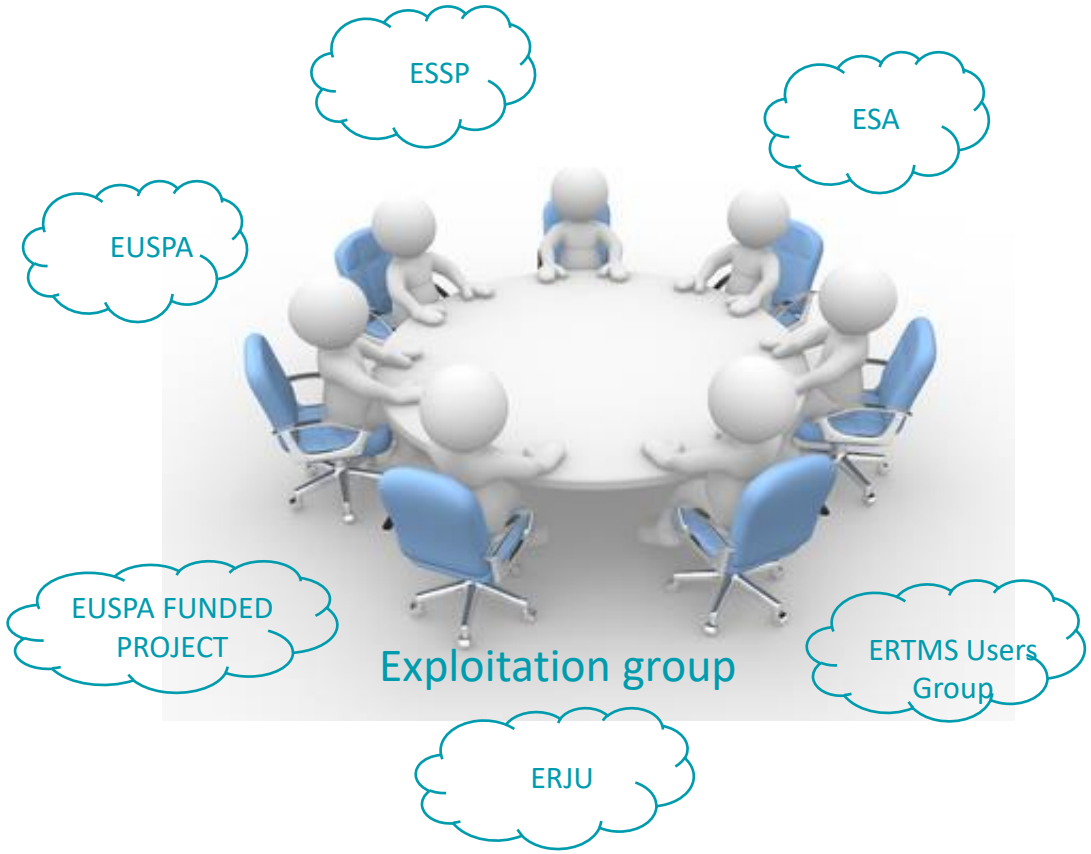
Final Conference (M24)

Social Media

Newsletters (M12) (M24)

Events and Congress

Task 6.7 Exploitation



UNIFE
6-24 Month

Additional activities

- Strong working relations with ERJU
  - X2RAIL-5
  - R2DATO
- Seek oportunities for synergies

T6.5 Business case

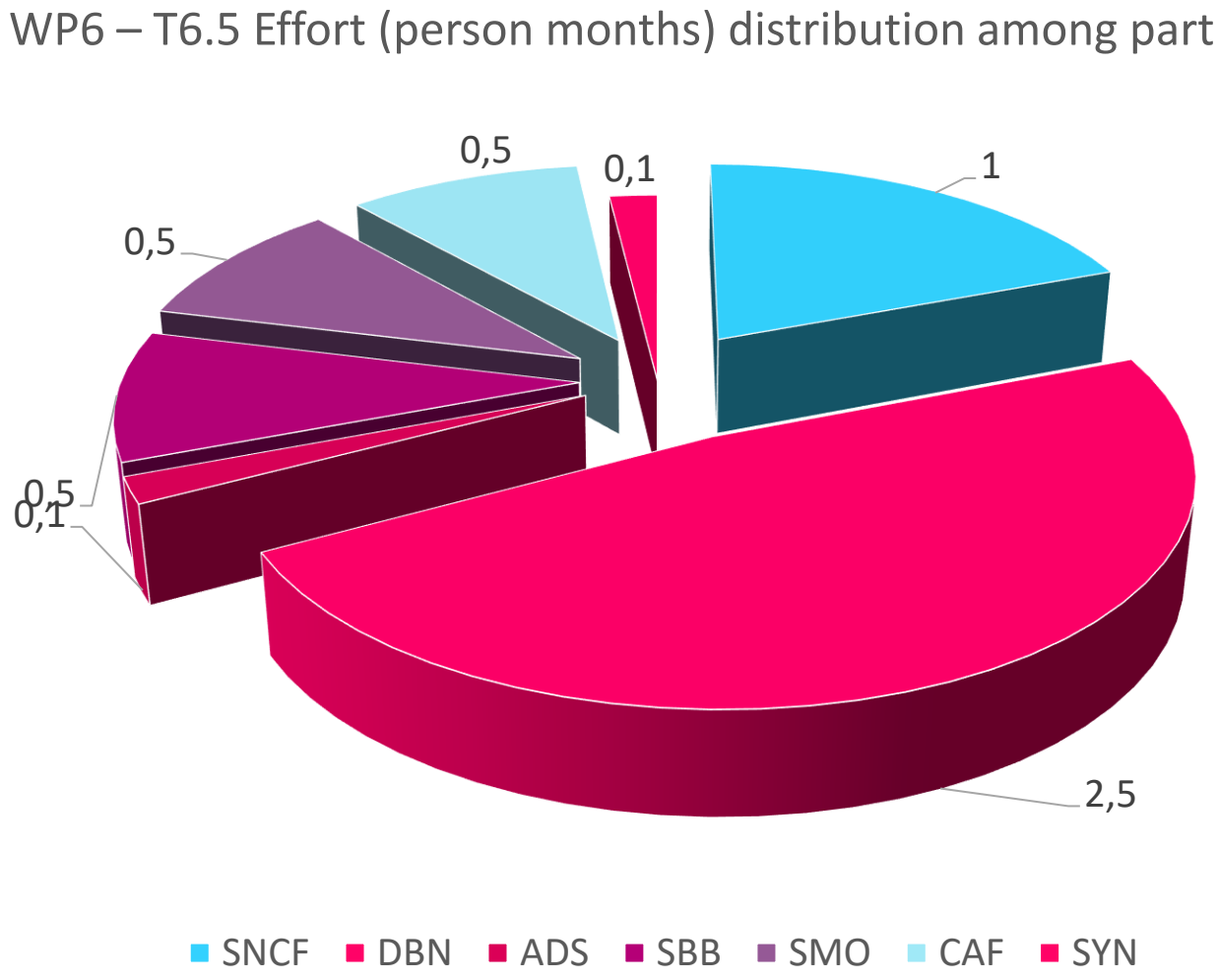
Targets:

1. Review previous studies and analysis that have been made on the implementation of a GNSS-based LOC-OB system and the business-related outcomes (e.g., CLUG, EUG-LWG, Shift2Rail, etc)
2. Perform a cost-benefit-analysis (CBA) on the impact of a GNSS based absolute safe train positioning on the rail operations of the future i.e., fully automated train operation and moving block

Duration: M12-24

Mode of collaboration: regular update calls to align on progress and to-do's; background work is mainly data collecting and building Excel model

T6.5 Business Case



T6.5 Business case

Approach:

- **Basis:** Do not reinvent the wheel! → rather use methodologies of existing cost-benefit analyzes of GNSS based LOC-OB systems
- **Procedure:** Review, refine and elaborate on elements treated in existing studies and bring more details into assumptions
- **Methodology:**
  - Compare scenario with a system equipped with trackside localization elements against scenario with onboard localization and its related costs
  - Scenarios can be either for one or multiple countries and/or individual tracks
  - No migration scenario assumed

T6.5 Business case

Dependencies to other work packages/results:

- **Quantification of reduction of field elements through GNSS LOC-OB system**, e.g., 1/3 balises required as fall-back level, 50% of axle counters, …; this is essentially needed in **quantity per km**
- **Cost assumptions for required LOC-OB equipment**, incl. e.g., digital mapping, assumed train integrity solution, …
- **Aligned cost assumptions for infrastructure elements**, e.g., balises, axle counters, scope of those cost assumptions (incl. installation, pure hardware, …)

T6.6 Standardization

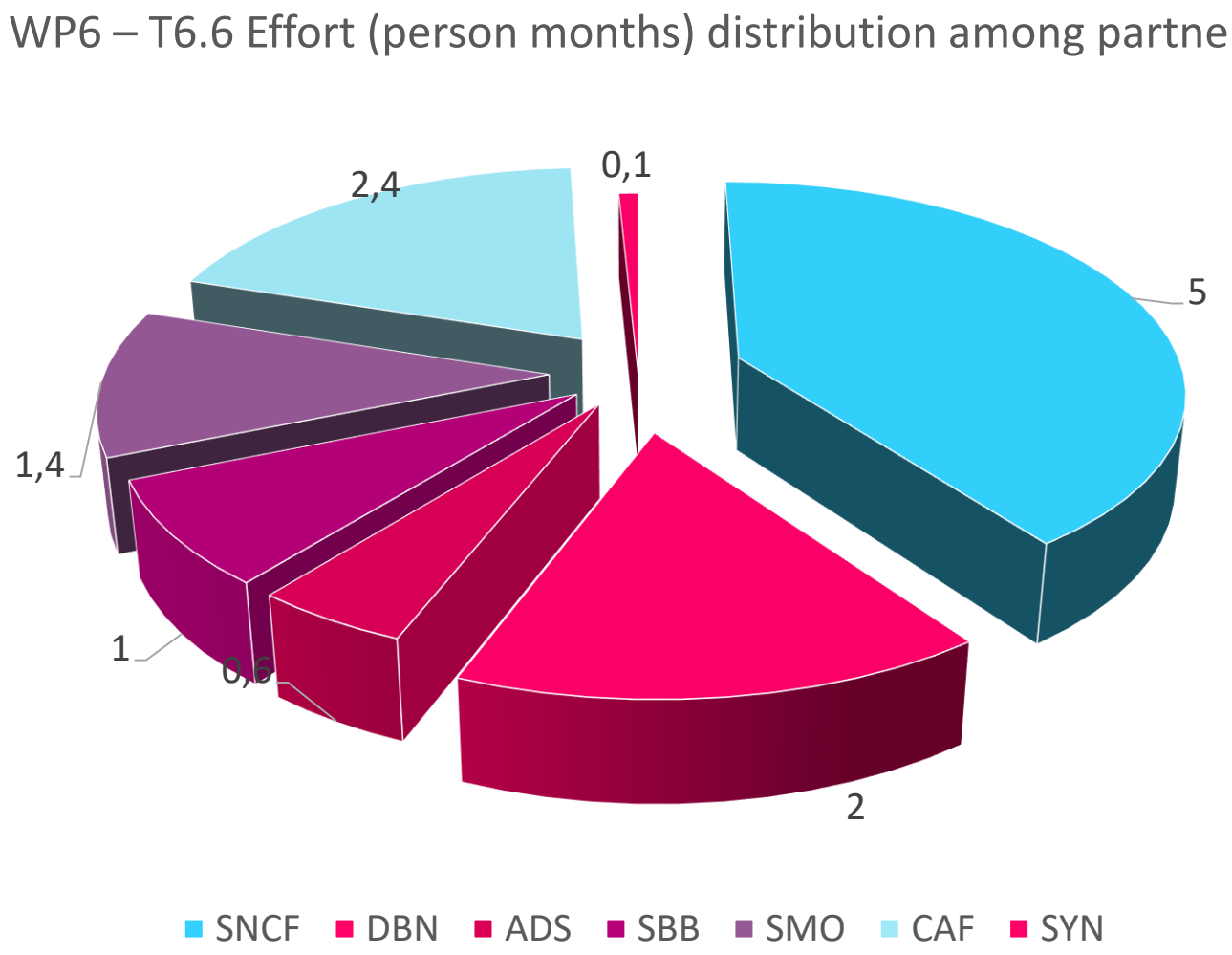
Targets:

1. Perform architecture Trade-off Analysis and Proposed Localisation On-Board System
2. Conduct Gap Analysis on Proposed Localisation On-Board System Requirements

Duration: M16-24

Mode of collaboration: Regular update calls to align on progress and to-do's; Document the Analysis in word document to be handed as deliverable.

T6.6 Standardization



T6.6 Standardization

Approach:

- **Basis:** Agree on measurable targets for the trade off analysis and document the differences
- **Procedure:** Review similar architectures from other European projects (ERJU, OCORA, X2R) consider the inputs from system definition clug 2
- **Methodology:**
  - Prepare a List of measurable targets for comparing the different architectures
  - Prepare a list of parameters which can be evaluated in available system definitions around other projects and related deliverables
  - Compare different architectures from the European landscape and document the differences in approach of the architectures
- **Dependencies on other workpackages**: (WP2, WP3, WP5) System Definition, Operational Context and needs, Performance Analysis

General Risk Analysis

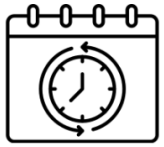
RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R1: Lack of efficiency during collaborative work done with heterogeneous partners.	All	Medium	Medium	Medium

Mitigation Action Plan or Specific Comments

The consortium already defined some work packages or tasks in deeper breakdown and decomposition.
Other measures can be considered, such as adjusting the best partner available competences in case of any change of this current plan, limiting the contribution to maximum 3 partners (leader included) when possible.
Collaboration efficiency will be monitored at TMT level.

RISK ANALYSIS



Risk Description	WP involved	Probability	Impact	Risk Level
R2: Delays due to high dependencies between and within tasks in the different WPs	WP2, WP3, WP4	Medium	High	Medium

Mitigation Action Plan or Specific Comments

Interdenpendencies diagram are created to identify bottleneck and monitor them.
Incremental approach of the WP2 tasks to deliver as soon as possible requirement to the WP3 and WP4.
Incremental approach of WP4 tasks with the delivery of intermediate stable deliverables to WP3 to perform the safety analysis.
The simultaneous top-down and bottom-up methodology already enables adaptations in case of one stream is delayed.
Other measures can be considered, such as changing the task allocation to partners as soon as a partner warns the consortium about a key resource or skill issue inducing a planning delay.

RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R7: Staff departure	All	Low	Low	Low

Mitigation Action Plan or Specific Comments

The partner shall:
1) inform UNIFE/SNCF and relevant WPLs (and sub-WPLs) as soon as it gets the information.
2) within one week organize a dedicated meeting with the key personnel to:
- make a status on his/her activities and next milestones,
- discuss possible candidates to take over the activities based on required skills and profile
- organize a seamless transition between the former and the new personnel
3) within two weeks, indicate to UNIFE/SNCF and relevant WPLs (and sub-WPLs), who will be take over the activities, when, and presents the plan for the transition period. (*)
4) When the change of personnel is effective, UNIFE to circulate the updated CLUG2.0 contact list internally to the consortium.

(*) In the extreme case, it is not possible for the partner to designate a relevant new key personnel among its team, this personnel will be looked for among the other consortium members and a transfer of tasks and budget would need to be agreed among the relevant companies. In such a case, dedicated meetings will be organized by the partner, involving UNIFE/SNCF and other companies who might have the necessary profiles.

RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R8: Impossibility to organize project events in physical due to covid or equivalent	All	Low	Medium	Medium

Mitigation Action Plan or Specific Comments

Replaced by online event in conference or webinar format. Final decision to go for an online event should be taken two month before the event target date.
Invitation will be sent to mailing list of persons of interest gathered during the project.

RISK ANALYSIS

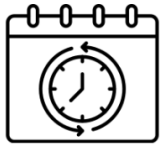
Risk Description	WP involved	Probability	Impact	Risk Level
R9: Data / format incompatibility	WP2, WP4,WP5	Medium	Very High	High

Mitigation Action Plan or Specific Comments

Mitigated by a bottom-up approach (experimental) A preliminary interface definition between sensors and algorithms is already in place from CLUG1.
CLUG2 WP4 & WP5 update this format interface definition in order to add the data needs for CI and integrity computation.
The experimented ICD will feed WP2 for preliminary specification and future standardization (out of CLUG2 project).
Use of standard interface format.
Partners shall agree on

- Defining a process to choose an Interface/format before starting a deliverable
- Deciding a common middleware like ROS
- Agreeing the format and Interface of the data before producing the data
- Agreeing on the tools to work with the data before producing the data
- Agree Standard Interface definition for hardware interfaces (opensource)

RISK ANALYSIS



Risk Description	WP involved	Probability	Impact	Risk Level
R10:Undervaluation of human and/or technical resources, investment	All	Medium	High	Medium

Mitigation Action Plan or Specific Comments

Technical progression of tasks and associated efforts will be monitored at TMT level.

RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R12: Impossibility to reach THR requirement	WP3, WP4	Medium	High	Medium

Mitigation Action Plan or Specific Comments

WP2 and WP3 focus on the right and just needed each localization parameter requirements (e.g. along track position, speed, acceleration, direction, track id, attitudes…) with for each their performance (e.g. position MCI<10m for speed <36km…) and Safety (e.g. THR< 5E-10/h, no single failure, SIL4…) as a classical top-down approach;
Simultaneously, WP4 follows a bottom-up approach and focus on one hand on function prototyping providing these localization parameters in the targeted performances and on the other hand the system performances engineering (Integrity Availability so THR) analyzing the safety performances.

Potential gap in THR between the top-down and the bottom-up approaches will be traced and managed during the project and will concern another phase targeting the physical architecture (component selection, adding independent redundancy…) for industrialization of a solution that is not the CLUG2 objective.

RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R18: Staff unavailability due to the parallel work in R2DATO	All	Low	Medium	Medium

Mitigation Action Plan or Specific Comments

This risk is a particular case of R10. Mitigation measure taken in R10 can be applied here.

RISK ANALYSIS

Risk Description	WP involved	Probability	Impact	Risk Level
R19: Different expectations regarding the project scope and objectives between the partners and with respect to EUSPA	All	Very Low	High	Medium

Mitigation Action Plan or Specific Comments

Detailed WorkPackage descriptions have been defined for each WP in order to ensure that each partner agree on what is expected from them in each task of each WP. The associated effort has also been precised and defined accordingly to the size of the task.
TOLBU development Roadmap will give TRL expectation.

Q&A

THANK YOU

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