Project overview

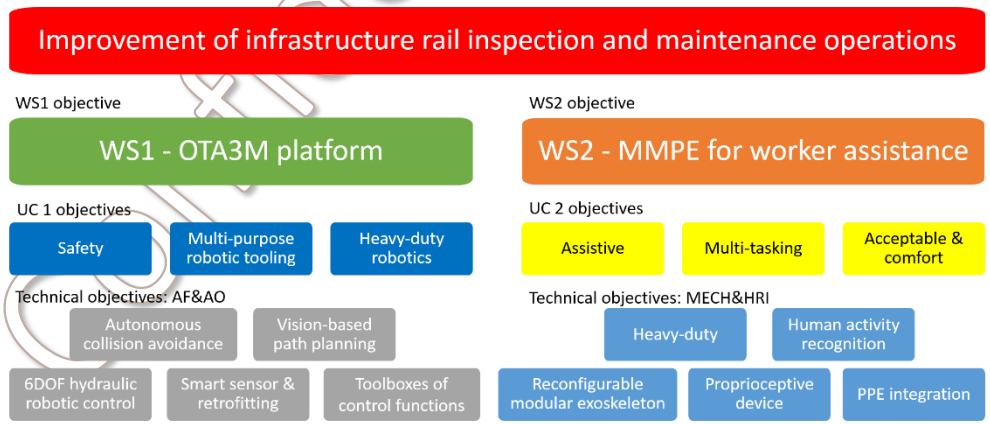
STREAM

IIT – Istituto Italiano di Tecnologia

Project objectives

STREAM will deliver **two methods** to improve competitiveness in railway maintenance applications:

1. The main goal of **WS1 is the development of a generic design framework for an On-Track Autonomous Multi-purpose Mobile Manipulator (OTA3M).** The OTA3M is a new automated and smart control platform adapted to existing plants, together with autonomy-enabling software functionality that uses robotics principles and Robot Operating System (ROS). This will introduce a level of autonomy and intelligence to on-track machines (OTMs).
2. The main goal of **WS2 is to develop a Modular Multitasking Powered Exoskeleton (MMPE).** We aim to deploy a modular wearable exoskeleton to reduce the risk of injury by assisting workers in physically demanding activities. This will ultimately improve the worker operational efficacy, health, quality of life, safety, and dignity.



Work Stream		Use Case		Technical development
WS1	Robotic autonomous maintenance	UC1	Railway track maintenance and inspection	• Autonomous Functions (AF) [WP2] • Autonomous Operations (AO) [WP3]
WS2	Exoskeleton for injury prevention	UC2	Maintenance general manual operation	• Wearable Robot Mechatronic Design (MECH) [WP4] • Human-Robot Interaction (HRI) [WP5]

Ambition WS1

OTA3M: **On-Track Autonomous Multi-purpose Mobile Manipulator**

Work Package 2 proposed innovation

- Development of a **control platform** as generic toolboxes for helping the **conversion of OTMs into multi-purpose autonomous OTA3M** towards meeting the railway application domain specific safety requirements (e.g., EN 14033-1/4 and EN 15746-1/2).
- Point-to-point controller for **autonomous OTA3M in running mode**, formulated as a mobile robot controller with collision avoidance (in AGV-style).
- Development of a **perception system that acquires a real-time multimodal 3D point-cloud** of OTA3M surrounding outdoors environment to enable safe autonomous OTA3M mounted excavator arm swinging motions.

Work Package 3 proposed innovation

- High dynamic performance **excavator hydraulic 6DOF arm robotic control**.
- High performance **contact force/motion control** algorithm for safe execution of real-world autonomous maintenance assembly tasks.
- A **collision avoidance control** with perception functions to track both stationary and moving objects within virtual working gauge or in its close proximately.
- Flexible autonomous vision based OTA3M TCP **path planning and quality assessment functionality for as-build 3D model reconstruction**

Ambition WS2

MMPE: **Modular Multitasking Powered Exoskeleton**

Work Package 4 proposed innovation

- **Reconfigurable MMPE** comprehensive of the Intelligent Unit (IU), the Wearable Unit (WU) and the Assistive Unit (AU) for lower-back assistance.
- MMPE designed for **heavy-duty** use (wide range temperature and water-resistant).
- MMPE that **integrates PPEs** improving acceptability and safety

Work Package 5 proposed innovation

- **Multi-tasking assistance** strategies to enable versatile control for track workers.
- **Specific assistive strategies** to assist worker tasks (holding, lifting, carrying, pulling, pushing, walking).
- Effective **Human Activity Recognition** strategy
- MMPE implements **IoT remote monitoring of safety functions** by fusing signal of embedded MMPE sensors.

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Work Packages & PERT

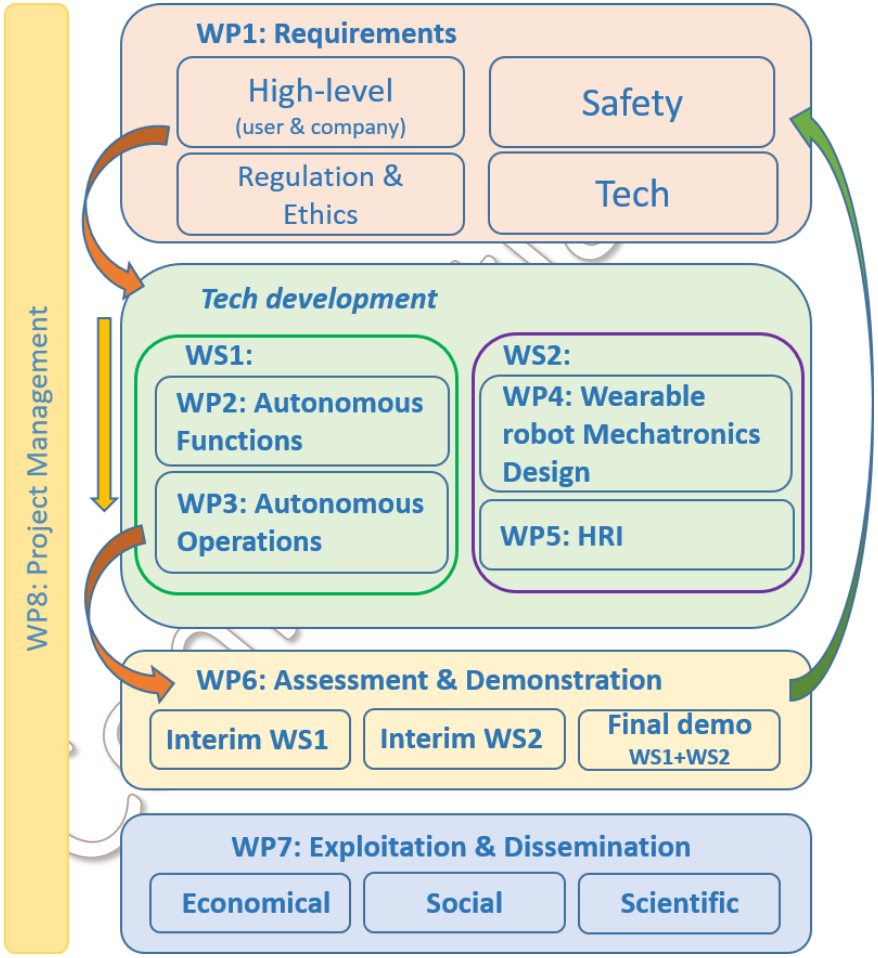
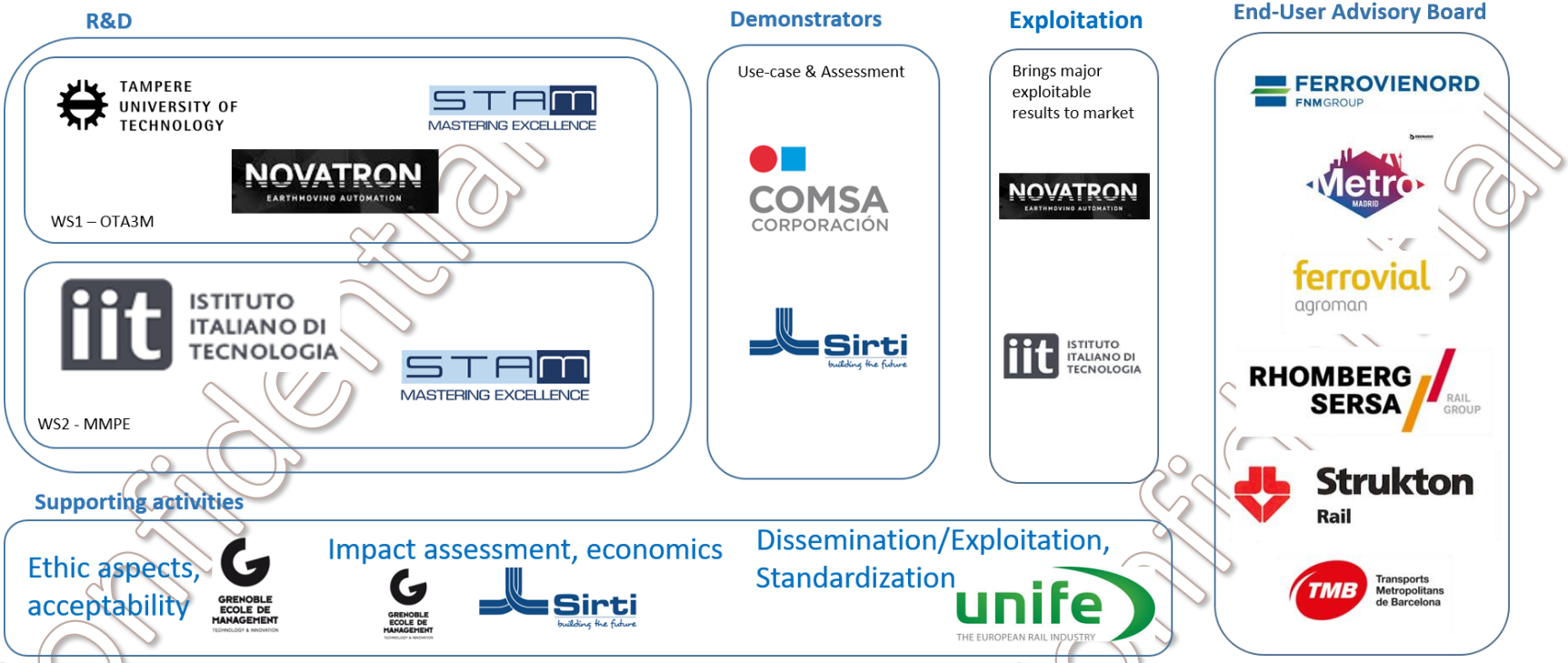


Table 3.1a: List of work packages

Work Package		Lead
No	Title	Short Name
1	Requirements	SIRTI
2	Autonomy Functions (WS1)	TAU
3	Autonomous Operations (WS1)	NVTR
4	Wearable Robot Mechatronic Design (WS2)	IIT
5	Human-Robot Interaction (WS2)	STAM
6	Assessment & Demonstration	COMSA
7	Exploitation & Dissemination	UNIFE
8	Management	IIT

Partener involvement



List of participants

N.		Name	Role & WS		Type	Country
1	IIT	Fondazione Istituto Italiano di Tecnologia	Coordinator, R&D	WS2	RTO	IT
2	TAU	Tampereen korkeakoulusaatio sr	R&D	WS1	UNI	FI
3	STAM	Stam S.r.l.	R&D	All	SME	IT
4	NVTR	Novatron Oy	Develop.	WS1	LE	FI

List of participants

N.		Name	Role & WS		Type	Country
5	GEM	Grenoble Ecole de management	Acceptability	All	UNI	FR
6	UNIFE	Union des Industries Ferroviaires Européennes	Diss&Expl. standards	All	SME	BE
7	COMSA	COMSA SAU	End-User	All	LE	ES
8	SIRTI	Sirti S.p.A.	End-User	WS2	LE	IT

STREAM

STREAM End-User Board (EUB)

Objective of STREAM EUB:

Gather feedback from the entire European community:

- to communicate regularly information
- To collect feedbacks as potential users and customers of the solutions developed in the project

Benefits of being part of the EUB:

- To obtain information about the development of the project (through specific meetings and workshops)
- To support in the definition of Technical Requirements
- To be involved in the definition of trial scenarios and specific use cases
- To contribute to prototypes trials and the system evaluation

Up to now the following organizations expressed their interest to serve as EUB members:

1. *Ferrocarril Metropolità de Barcelona, ES - www.tmb.cat*
2. *Metro de Madrid, ES - www.metromadrid.es*
3. *Ferrovial, ES - www.ferrovial.com*
4. *Strukton, NL – www.strukton.com*
5. *Rhomberg Sersa Rail Group, AT - www.rhomberg-sersa.com*
6. *Ferrovie Nord, IT - www.ferrovienord.it*

Shift2Rail

Project overview

STREAM – starting project: December 2020

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