ANNEX 1.1: JARVIS OC1 TECHNICAL DESCRIPTION v1.4

Submission Deadline: 16th of May 2025, 17:00 CET

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Version	Issue Date	Changes
Annex 1.1: JARVIS OC1 Technical Description v1.1	09.04.2025	Update of section 7.2 Evaluation during the programme. Payments are based on the lump sum mechanism.
Annex 1.1: JARVIS OC1 Technical Description v1.2	23.04.2025	In challenge 4, the text was updated to clarify that the listed types of infrastructures and solutions are indicative examples.
Annex 1.1: JARVIS OC1 Technical Description v1.3	25.04.2025	Update of section 7.3, cost statements were removed from the list of deliverables for Sprint1, Sprint2, Sprint3.
Annex 1.1: JARVIS OC1 Technical Description v1.4	30.04.2025	Deadline changed

1 INTRODUCTION

JARVIS is a European funded project under the Horizon Europe Programme that focuses on developing reusable tools for enhancing the uptake of AI-driven multimodal Human-Robot Interaction by Industry. Specifically, **JARVIS** aims to develop and validate intelligent robotic solutions for agile manufacturing and industrial Inspection and Maintenance (I&M). The project approach is designed to enhance the flexibility, adaptability, and efficiency of human-robot collaboration in complex industrial settings.

The project focuses on improving the interaction of humans and robots, ensuring workplace safety, and cost-efficiency through AI-powered automation. The **JARVIS** framework consists of a comprehensive set of enabling technologies and methodologies and emphasizes flexibility and interoperability for robotic application development. The rapid technology deployment and reconfigurability is a priority for **JARVIS**, so the consortium targets at providing standardized tools and interfaces, which can support technology providers in creating and implementing innovative, scalable, and cost-effective industrial robotics solutions.

JARVIS technologies will be tested and validated in four pilots coming from the automotive, aeronautics and energy industries, while the Open Call will provide the opportunity to further test the **JARVIS** framework in other domains, and cases.

This guide presents the challenges of the Open Call and elaborates on the **JARVIS** functionalities that can be provided to the applicants to enhance the capabilities of their solutions. The guide provides material to take into consideration while preparing your proposal for the **JARVIS** 1st Open Call, helping you understand the technologies that fit the call and the proposed challenges.

2 TEAM

The **JARVIS** consortium brings proven expertise in robotic solutions for advanced Human-Robot Interaction in agile manufacturing, as well as inspection & maintenance applications. Building upon knowledge from previous projects and insights gained in the **JARVIS** first year, consortium partners—including technical providers, and research institutions—will mentor the approved External Pilots of the 1st Open Call. Below is a brief overview of the organizations leading this mentoring process.

LMS Laboratory for Manufacturing Systems & Automation	**LMS** is a leading European laboratory, specializing in robotic applications in industrial and collaborative environments, human-robot interaction (HRI), autonomous task planning, virtual and augmented reality and AI development for real world shopfloors. LMS has proven experience in coordination, technical contribution and management of EU-funded projects (Project coordinator: THOMAS, SHERLOCK, ODIN and CONVERGING, Node leader in AI Testing and Experimentation Facilities of AI-MATTERS, Project manager in X-act and ROBO-PARTNER). LMS is the coordinator of the **JARVIS** project, leading user-centric design for Human-Robot Interaction, Robot behavior adaptation to human needs and social interaction, and learning of social skills for the robots by observation.
tecnalia MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE	**TECNALIA** is the largest center of applied research and technological development in Spain, a benchmark in Europe and a member of the Basque Research and Technology Alliance. We collaborate with companies and institutions to improve their competitiveness, people's quality of life and achieve sustainable growth. We do it thanks to people who are passionate about technology and committed to building a better society. We work with an increasingly strategic business relationship model based on trust, collaboration, and a shared technological approach, whereby our main scopes of action are: smart manufacturing, digital transformation, energy transition, sustainable mobility, health and food, urban ecosystem and circular economy. We are the first private Spanish organization in contracting, participation, and leadership in the European Commission's Horizon Europe programme and we are ranked fourth in European patent applications.
cea	The French Alternative Energies and Atomic Energy Commission (**CEA**) is a key player in research, development and innovation. The mission of the CEA-List institute, a smart digital system specialist, is to combine scientific excellence in high-fields like robotics and artificial intelligence.
Tampere University	Tampere University (**TAU**) is one of the most multidisciplinary universities in Finland. We bring together research and education in technology, health and society. The university is known for its excellence in teaching and research, and it collaborates with hundreds of universities and organizations worldwide. Our community consists of 21 000 students and over 4000 staff members from more than 80 countries.
KUKA	**KUKA** is a global automation corporation with sales of around 3.3 billion euro and roughly 14,000 employees. The company is headquartered in Augsburg, Germany. In the JARVIS project, KUKA primarily focuses on workplace perception, developing AI-based algorithms capable of transforming raw data gathered from heterogeneous sensors into meaningful information. To enhance human-robot collaboration, the scene, such as a robotic cell, should be represented not only by a point cloud but should also contain semantic

	information. To achieve this, KUKA will tackle the problem of scene understanding and the detection of discrepancies or misplacements of parts. This can also contribute to preventing collisions between robots and humans. This development is evaluated through industrial use cases, particularly in the aeronautics industry by manufacturing passenger aircraft seats, and in the automotive industry by assembling hybrid car battery packs.
netcompany intrasoft	Netcompany-Intrasoft (**INTRA**) is a leading European IT Solutions and Services Group with strong international presence and expertise, offering innovative and added-value solutions of the highest quality to a wide range of international and national public and private organizations. Netcompany-Intrasoft's expertise and strength lie in its proven capacity and successful track record in undertaking and delivering, complex, mission – critical projects. Netcompany-Intrasoft's professionals have developed the ability to combine their technical expertise with thorough understanding of each customer's individual business needs. The company consists of a highly skilled, efficient and flexible human resources base, with an international culture. Netcompany-Intrasoft is a company that understands research & innovation as key enabler for future growth and new business creation. Netcompany-Intrasoft has its own Research & Innovation Development (RID) Department that actively contributes to the development of innovative research prototypes.
Collins Aerospace An RTX Business	**Collins** Aerospace, an RTX business, is a leader in integrated and intelligent solutions for the global aerospace and defence industry. Our 80,000 employees are dedicated to delivering future-focused technologies to advance sustainable and connected aviation, passenger safety and comfort, mission success, space exploration, and more.
SINTEF	**SINTEF** is one of Europe's largest research institutes, with multidisciplinary expertise within technology, natural sciences, and social sciences. SINTEF is an independent foundation which, since 1950, has created innovation through development and research assignments for business and the public sector at home and abroad. SINTEF Digital's Mathematics and Cybernetics team is playing a role in shaping the JARVIS project requirements and specifications. Additionally, SINTEF is the primary technical partner for the offshore energy production use case. Lastly, SINTEF will monitor and provide guidance for the third-party projects utilizing the JARVIS use cases.
Teaching Factory	Teaching Factory Competence Center (**TF-CC**) is oriented on providing training and innovation services to the manufacturing industry. TF-CC focuses on enabling the knowledge exchange between academia and industry and on creating added value for the services and products of manufacturing companies, by promoting innovative technology and research activities performed by academia. For this scope, TF-CC provides a set of Training Services and Innovative Technical Services to their customers aiming to interdisciplinary learning, research & experimentation and to exploit of research results towards industrial applicability in pilots.

3 JARVIS CHALLENGES

The requirements below apply to all of the 7 JARVIS challenges

Existing Pre-Conditions: the applicants should justify their ability to deploy the solution on-site for testing or their ability to create a relevant testbed. In cases where relevant, the applicants must provide their own robot.
Prototypes: must be designed to operate effectively in the potentially challenging conditions set by the selected use case (e.g., human presence, harsh weather, etc.).
Use of open source: applicants are encouraged to use open-source technologies where feasible to accelerate development, reduce costs, and ensure interoperability.
Security, privacy and safety: should be taken into account to minimize risks to users both in terms of physical harm and in terms of digital privacy and security.
User studies: should be conducted to evaluate operators' acceptance of the proposed solutions
Business case benefit/cost performance: should emphasize the added value of the proposed solution and fit for market.

1) Human Augmentation and Assistance for Safe and Adaptive Manufacturing

The manufacturing sector requires gradually higher levels of flexibility, adaptability, and efficiency, which often induce significant cognitive and physical strain to employees. Although automation has been tested to alleviate strenuous and repetitive tasks, it is not always cost-effective or technically viable. On the other hand, the industry-specific workers' knowledge and skills are valuable and should be preserved. Technologies including AI, XR interfaces, exoskeletons, as well as teleoperation hold promise to augment human capabilities under dynamic production environments, improving safety, productivity and operator's well-being.

Applicants should propose and implement solutions in use cases inspired from assembly lines, maintenance & repair operations, logistics, or similar focusing on one of the following areas:

1) Intelligent Wearables: Wearables such as exoskeletons assisting workers in physically demanding tasks (lifting, repetitive assembly, and prolonged standing) or AR glasses supporting intellectual tasks are expected under this challenge.
2) AI-Augmented Decision Support: AI-driven cognitive assistants combined with advanced interfaces aiding operators at mentally demanding tasks such as maintenance procedures, or assembly operations.
3) Adaptive Workstations: AI-enhanced workstations that are dynamically adjusted to operator's preferences, fatigue levels, experience, and work patterns.
4) Human-Robot Interaction modalities and user assistance: co-manipulation or teleoperation-based user interfaces, with advanced user assistances such as virtual guides, collision avoidance, teaching by demonstration capabilities, adaptive skills for interactive semi-automation. Digital twin and 3D perception can be key enablers for these features. Solutions should focus on improving the user experience by providing natural and efficient ways of controlling and interacting with the robots.

This topic encourages the implementation of human-centric approaches, whereas the achieved results should target at improvement of operators' safety, system adaptability, and seamless integration of AI-driven assistance, where relevant.

2) Agile collaborative robotics for logistics and warehousing

Warehouses, factories, and distribution centers tend to heavily rely on manual material transportation often requiring multiple workers to handle large or heavy loads. These tasks are physically demanding, repetitive, and ergonomically challenging causing worker fatigue and inefficiencies in logistics operations.

Full automation in material handling and warehousing has proven impractical in dynamic environments, making AI-driven solutions and human-robot collaboration (HRC) necessary to improve worker safety, efficiency, and resource utilization.

The consortia are invited to develop and showcase their solutions in one of the following cases:

1) Material Handling & Transportation: AI-assisted robots, cobots, or mobile robotic platforms working alongside human operators for large stock materials and heavy or bulky objects handling in complex environments should be presented. Relevant technologies include semi-autonomous navigation for dynamic warehouse environments and AI-driven inventory management for workflow optimization. Examples of applications include robot-assisted pallet handling, co-manipulation of oversized goods, semi-automated transport for just-in-time inventory management enhanced with machine learning or predictive analytics.

2) Adaptive Picking, Packing & Sorting: Robotic systems that collaborate with humans in dynamic environments, for efficient object retrieval, packaging, or classification in high-mix, low-volume production. AI-driven perception and grasping solutions should enable handling of variable product types, packaging formats, and storage conditions to optimize warehouse operations. Autonomous navigation, teleoperation, and remote robotic control should support efficient workflows, while XR interfaces and smart ergonomic assistive devices such as exoskeletons should enhance operator capabilities and safety. Machine learning and predictive analytics can further contribute to workflow optimization and real-time decision-making.

Proposed solutions should enhance human capabilities while ensuring safe, efficient, and scalable logistics and warehousing operations.

3) Generative AI and Human-Robot Collaboration for Efficient and Scalable Remanufacturing

Remanufacturing plays a key role in sustainable production by extending the lifecycle of used components. Core remanufacturing processes such as cleaning, surface treatment, disassembly, reprocessing, and reassembly often expose operators to ergonomics risks or hazardous conditions. Additionally, long reconfiguration times and the need for adaptive processing slow down workflows and necessitate human involvement. Therefore, remanufacturing processes are largely manual with component variability being the greatest obstacle to automation.

Generative AI (GenAI), Human-Robot Collaboration (HRC) and teleoperation can overcome the limitations of conventional automation solutions by enabling adaptive decision-making, reconfigurable automation, and scalable remanufacturing workflows. AI-powered systems can also assist with process planning, predictive analytics, and remote operation, making remanufacturing more efficient, flexible, and sustainable.

The consortia should showcase the added value of such solutions in one of the following cases:

1) **Human-Robot Disassembly & Sorting of reusable parts from end-of-life products** Proposed solutions should integrate collaborative robots and intelligent grasping systems for adaptable disassembly and/or sorting. Machine learning and predictive analytics can enhance efficiency by classifying and selecting reusable components based on their condition and suitability for remanufacturing.
2) **Assisted Cleaning, Surface Treatment**, **Reprocessing or Repairing processes** proposed solutions should demonstrate human-robot collaboration, teleoperation, or advanced user interfaces and exoskeletons to improve precision, adaptability, and process efficiency. Applications may include surface treatment processes (e.g., abrasive blasting, laser cleaning, ultrasonic techniques) and repairing or reprocessing involving welding, grinding, deburring, and additive manufacturing (3D printing for repair).

The proposed solutions should improve operator safety and support decision-making, while enhancing resource efficiency and ensuring scalable and adaptable processes.

4) Inspection and Maintenance of Plants, Infrastructure Areas and Linear Infrastructure

This challenge encompasses Inspection and Maintenance of industrial plants, infrastructure areas and linear infrastructure and invites applicants to address relevant operations by using robotics solutions and human-robot interaction implemented in unstructured areas coming from industrial or public sector use cases. The challenge involves **inspection and maintenance of relevant infrastructure including, but not limited to, electrical substations, offshore and onshore oil and gas (O&G) facilities, harbours, subsea installations, nuclear facilities, power stations, airports, quay walls, and municipal areas**, as well as inspection and maintenance solutions for **railways, tunnels, bridges, dams, waterways, wastewater networks, drinking water systems, pipelines (above ground, in tunnels, or underwater),** and **power lines**, as well as the **surrounding areas (e.g., structural integrity of railway foundations or vegetation near infrastructure)** can be proposed under this challenge.

In both cases, "resident" robots can also play a critical role in emergency response, acting as first responders in the facilities or infrastructure they operate. They are highly relevant for tasks such as identifying fallen trees on power lines, assessing avalanche impacts near roads and railways, or providing situational awareness for effective emergency handling. Robots should operate at different levels of autonomy depending on the tasks to be done, communication availability, etc., and can in some cases be teleoperated.

Applicants should propose solutions for one of the following areas:

1) **Solutions focusing on Inspection** should include, but may not be limited to, one or more of the following, **sensor modalities and infrastructure damages**.
    - Sensors: EO-camera, infrared, sound (omnidirectional and directional), vibration sensors, gas sensors, non-destructive testing (e.g., Ultrasonic Thickness Measurement).
    - Damages: corrosion, pitting, cracks, gas leakages, diffuse gas leakages, anomalies, etc. Monitor risk of overflow water in municipalities areas.
2) **Solutions focusing on Maintenance** should involve but may not be limited to: Cleaning (water, sand, chemicals, brushes), plastering, cutting deburring, welding, additive processes for repair and renovation, pick-and-place objects, insert object, open door/cabinet, equipment replacement, push button, turn handle (e.g., valves), open hatches.

Applicants should propose robotic systems suitable for challenging environments, including aerial, underwater, surface (on water) and ground vehicles.

5) Inspection and Maintenance of Industrial and Public Sector Assets and Equipment

This challenge focuses on Inspection and Maintenance (I&M) of assets & equipment of industrial and public sector. Such assets include, e.g., pressure vessels, tanks, ship hulls, hydro production turbines, wind turbines, gas-/ steam turbines, flare-stacks, aquaculture infrastructure (e.g., net cages), generators and specific components on assets e.g., pipe bends, buildings, etc. This challenge also includes I&M of trains and other assets.

Robots are currently typically deployed and retrieved by humans (as opposed to being "resident") and are operated in various degrees of autonomy (including to be teleoperated).

Applicants should propose solutions for one of the following areas:

1) **Inspections** typically include, but may not be limited to, one or more of the following, sensor modalities and infrastructure damages.
    - Sensors: EO-camera, infrared, non-destructive testing (e.g., Ultrasonic Thickness Measurement).
    - Damages: corrosion, pitting, cracks, leakages, building damage (e.g. heat leak, water damage), etc.
2) **Maintenance** typically involves, but may not be limited to: Cleaning (using water, sand, chemicals, brushes), plastering, deburring, etc.

Robot types can be aerial, underwater, surface (on water) and ground vehicles.

6) Inspection Solutions for Assisted Inline Quality Assessment

Inspection and quality control in the manufacturing industry are becoming more complex due to the shift toward high-mix, low-volume production schemes. The increasing variety of product configurations makes consistency challenging, even with automated tracking and error-proofing systems. As a result, manual inspections remain essential but are cognitively demanding and prone to human error, particularly over long shifts. The challenge is greater in circular value chains, where assessing the condition of used components (cores) is necessary to determine whether remanufacturing or recycling is viable. Unlike new production, these components have varying degrees of wear, damage, or contamination, requiring accurate classification and sorting, which is still largely performed manually. However, conventional inspection methods are slow, inconsistent, and difficult to scale.

The consortia should propose solutions in one of the two following cases:

1) **Assisted Inline Quality Control** in Manufacturing.

2) **State Assessment** of Used Components (cores) for Remanufacturing & Recycling.

Applicants should present solutions based on AI and human-robot collaboration (HRC), which include but are not limited to sensor fusion (e.g., vision, infrared, ultrasound), machine learning and predictive analytics for quality assurance or remaining useful life estimation, Non-destructive testing (NDT) solutions, GenAI for synthetic data generation and defect classification and collaborative robots for adaptable inspection.

7) Open Topic & Novel Domain

This challenge allows applicants to propose a use case within a domain of their choice, ensuring that the proposal will align with the **objectives** and **technological areas** of JARVIS.

Specifically, the expected outcome is to **demonstrate added value** and **quality improvement** of outcome for complex tasks, such as complex industry processing tasks by deploying solutions based on human-robot interaction. In the selected use cases, robotics should be adding capabilities that extend human ability, but which require human interaction to be achieved, while varying levels of interaction and communication, dependent on the state of the task should be showcased. Demonstration of **human-robot interaction** at all levels from physical to social interaction in a variety of working environments can be proposed.

Proposals should include the demonstration of the solution operating in operational environment of key industries at pre-commercial scale.

If you do not see a predefined challenge that aligns with your needs and value proposition, this is the challenge where you may submit your own use case, so that we can explore new areas where JARVIS can foster innovation, and collaboratively create new opportunities.

4 JARVIS TECHNOLOGY ARCHITECTURE

4.1 JARVIS core components

JARVIS aims to develop a reusable set of tools that enable AI driven multimodal Human-Robot Interaction, focusing on:

- interfaces for physical and remote information exchange, robot control and programming,
- providing social skills to a variety of robots to achieve seamless user-centric interaction that enhances human capabilities in complex tasks and
- demonstrating scalability to ensure wide uptake of technologies across different industrial domains.

To achieve its objective, the JARVIS consortium has analysed industry requirements and designed a software architecture that effectively supports the project's goals. This architecture defines how JARVIS modules exchange data and interoperate using different forms of communication and dedicated APIs. JARVIS utilizes a service-oriented, distributed architecture that can fit into the centralized control requirements of a manufacturing and Inspection & Maintenance (I&M) system. A dedicated integration platform ensures interoperability and scalability.

JARVIS core modules are structured around four main pillars; Robot Interaction, User Experience Enhancement, Process Control and Cognition and Intelligence.

4.2 JARVIS tools

The tools offered by the JARVIS consortium have been designed based on industry requirements and project objectives. These tools are structured into the following pillars:

- **Robot Interaction**: This type of JARVIS tools target at natural direct and indirect human-robot interaction and deal with robot programming, teleoperation, and human-robot communication. They can address a wide range of scenarios, where the human can be present in the same cell with the robot or in a remote and safe area interacting with the robot through teleoperation.
- **User Experience Enhancement**: JARVIS promotes human-centric design of Human-Robot Interaction and complementarily to the tools of the previous pillar, provides user-friendly interfaces enhancing user experience (UX), as well as modules enabling the adaptation of robot behaviour to human preferences, needs and intentions, ensuring smooth interactions as if it was among humans.
- **Process Control**: The control and monitoring of the execution of JARVIS use-cases is accomplished through centralized orchestration, which sends execution commands and actions to the distributed resource-controlling modules and receives feedback on the progress of each action. The orchestration system is configured based on the human-in-the-loop principle by providing operators with tools to communicate their input.
- **Cognition and Intelligence**: JARVIS provides tools for enabling robot cognition. The tools include digital twins, perception systems enabling the prediction of human intention, as well as intelligent mechatronics. These tools aim to achieve robot autonomy, quality control and dexterous handling of parts.

More details on the JARVIS toolset can be found in the next section.

5 JARVIS FRAMEWORK

5.1 JARVIS tools available for 3rd party integration

From the JARVIS core sub-systems being developed, the following tools can be provided to the approved 3rd parties:

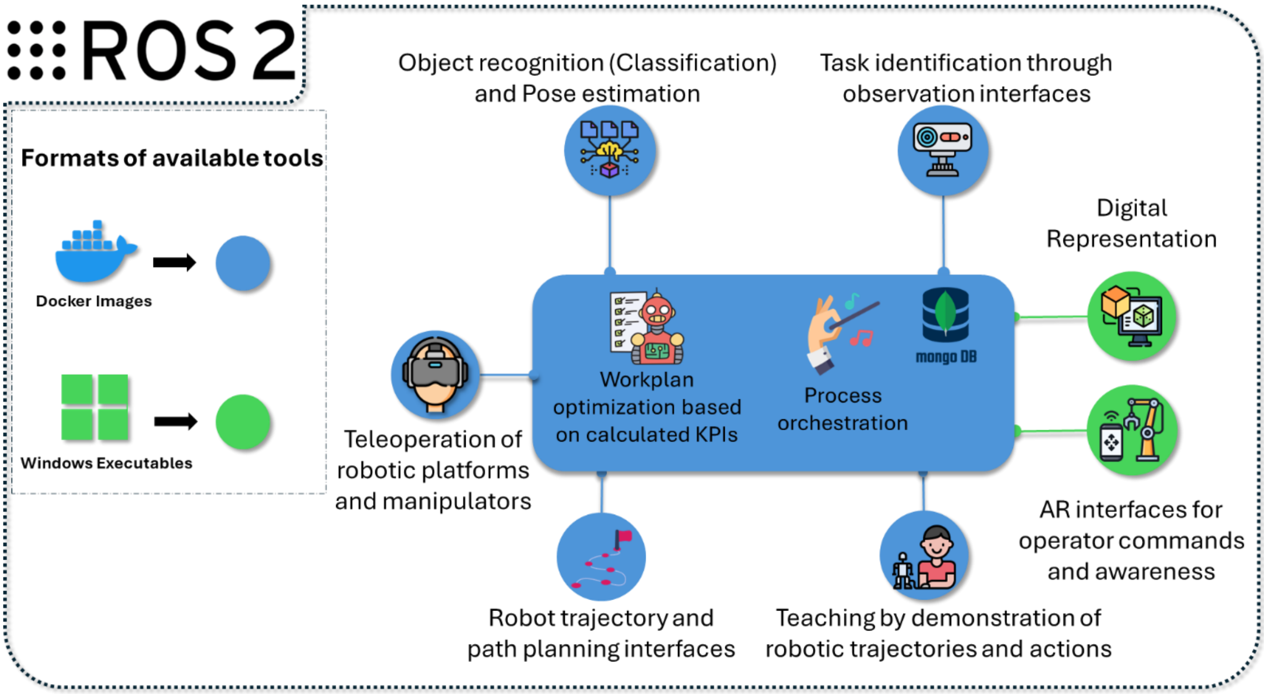

Figure 1: JARVIS tools available to 3rd parties.

5.1.1 Robot Interaction

- **Teleoperation of robotic platforms and manipulators:** Enabler for immersive robotic system control through motion-capture) and virtual reality headsets, as per the external pilots' needs. This toolbox facilitates remote, safe and precise manipulation of robotic arms and mobile platforms by operators.
  - The tool is made available as an executable with predefined ROS2 interfaces for communication, hardware is not included.
- **Teaching by demonstration of robotic trajectories and actions:** This tool is designed to enable easy and efficient robot programming. By using this tool operators can physically demonstrate simple tasks, and with the necessary behaviour such as the demonstrated sequence of actions, tool trajectories, speeds, etc, being translated into robot task plan relevant information and stored for future usage. This tool enables operators to easily adjust the robot's behaviour according to their needs, under predetermined constraints.
  - The tool is made available as a docker image with ROS2 interfaces.

5.1.2 User Experience Enhancement

- **AR projector interfaces for operator commands and awareness:** The Augmented Reality makes possible to overlay process and robot relevant information on surfaces of the physical cell. This in turn, allows providing real time feedback to the operators and facilitates intuitive human-robot interaction, focusing on enhancing situational awareness.

- The tool is served as an executable with ROS2 interfaces, projector hardware is not included.
- **Task identification through observation interfaces:** This tool allows to perceive the ongoing task of the operator. It is based on sensor fusion, and it aims at meaningful operator support and maximization of interactions efficiency.
    - The tool is served as a docker image with ROS2 interfaces.

5.1.3 Process Control

- **Workplan optimization based on calculated KPIs:** Key Performance Indicators (KPIs) analyser to dynamically adjust the task flow, reducing idle time and maximizing efficiency.
    - This module is served as a Docker image with ROS2 interfaces and MongoDB integration.
- **Process orchestration:** This tool is designed to improve the efficiency in the Coordination of robotic and human task effectively, ensuring time synchronization and task dependencies for a qualitive process execution.
    - This tool is served as a Docker image with ROS2 interfaces and MongoDB integration.

5.1.4 Cognition and Intelligence

- **Robot trajectory and path planning interfaces:** State of the art planning interfaces for designing and optimizing robotic motion paths, ensuring safe and efficient trajectory execution.
    - The tool is served as a docker image with ROS2 interfaces.
- **Digital Representation:** Digital twins utilizing powerful engines providing physics alongside appealing graphics. The module enables online process monitoring and offline simulations, allowing for a cost and time effective way to visualize and examine cell layouts, calculate process KPIs and validate decision making algorithms.
    - The tool is served as a pack of Windows executable and Linux Docker image with ROS2 interfaces.
- **Object recognition (Classification) and Pose estimation:** AI-driven vision systems allowing for object classification, which can be used for environment perception, product variant and discrepancies detection. Applicants may provide the annotated data needed for the model to work, and JARVIS will return the trained model, ready for application.
    - This tool is served as a Docker image with ROS2 interfaces.

5.1.5 How to expect to use the JARVIS tools

The 9 JARVIS tools are summarized on the following table:

Tool Name	Format	Interface
Teleoperation of robotic platforms and manipulators	Docker image	ROS2
Teaching by demonstration of robotic trajectories and actions	Docker Image	
AR interfaces for operator commands and awareness	Windows executable	
Task identification through observation interfaces	Docker Image	
Workplan optimization based on calculated KPIs	Docker Image	ROS2 and MongoDB
Process orchestration	Docker Image	
Robot trajectory and path planning interfaces	Docker Image	ROS2
Digital Representation	Windows executable	
Object recognition (Classification) and Pose estimation	Docker Image	

6 JARVIS DATA PRIVACY AND SECURITY

With JARVIS focusing on human-robot collaboration and data-driven solutions, security and privacy are main points of focus. This section outlines the philosophy of the consortium to ensure data security, integrity, and privacy throughout the project lifecycle.

6.1 Data Security

- Encryption of sensitive data
- Multi-factor authentication for access to JARVIS systems.
- Role-based access control to limit data access to authorized personnel.
- Regular security audits and vulnerability assessments.
- Activity monitoring to detect and respond to suspicious behaviour.

6.2 Data Integrity

- Data validation and verification processes.
- Regular data backups and recovery procedures.
- Version control for datasets and software components.

6.3 Data Privacy

- Obtaining informed consent from individuals before collecting their personal data.
- Minimizing the collection of personal data to what is strictly necessary for the project's objectives.
- Implementing data anonymization and pseudonymization techniques
- Establishing clear data retention policies.
- In general, alignment with EU GDPR.

6.3.1 3rd parties

For the 3rd parties, the following security and privacy rules must be followed:

- Assure full compliance to the GDPR and other applicable data protection laws.
- Use suitable data anonymization and pseudonymization techniques to safeguard individual privacy.
- Perform thorough risk assessments for all new components and use cases.
- Clearly and openly demonstrate to users how their data is gathered, utilized, and protected.

7 ACTIVITIES DURING THE FUNDED PROGRAMME

7.1 External Pilots (10 -month programme)

7.1.1 Sprint 1: Requirements

Sprint 1 is the starting point of each project and will last up to 2 months. Within this phase, beneficiaries must finalize the implementation plan, including key requirements and roadmap for the development and deployment of the funded pilot. The implementation plan should account for the integration of JARVIS tools with the rest of the technologies and the fulfilment of the project's objectives.

The outcome of "Sprint 1: Requirements" should include the following:

- description of how the project will be carried out.
- description of the technologies to use and their specifications.
- reporting of the technical development.
- list of detailed milestones, deliverables and KPIs to achieve (metrics and target values for how the success will be determined).
- use case description including process workflows – current state.
- a concept illustrating the envisioned use-case including the technology deployment.

At the end of Sprint1, beneficiaries should deliver:

1) a report presenting the technology adopter requirements, technical specifications of the solution, description of the baseline technologies/prototypes and roadmap to the final demonstrator together with the finalization of the case specific KPIs (see section 7.2 for more details) including baselines, as a means of verification of work performed.
2) a 1-pager dissemination material including the publishable summary of the results obtained at this stage.

7.1.2 Sprint 2: Development/Deployment

Sprint 2 lasts 6 months and is dedicated to the core development and deployment stage of the projects. Projects should follow their implementation plan delivered in Sprint 1 resulting in the:

- development of the required functionalities as identified in Sprint 1
- deployment of a demonstrator of the system prototype in relevant environment, including the JARVIS tool that the beneficiaries have selected from the list in section 5 of the present document.
- collection of relevant data to support to describe the operation of the initially deployed solution.

At the end of Sprint2, beneficiaries will have to deliver:

1) a video demonstration of the system prototype in relevant environment
2) a report describing the functionalities of the prototype, the achieved progress and nex steps
3) a publishable summary of the achieved progress.

7.1.3 Sprint 3: Validation

Sprint 3 marks the final stage of the project implementation, lasting two months. The focus is on validating the solution within the use case and outlining the potential for future exploitation and impact. Validation and exploitation activities should include:

- system prototype demonstration in an operational environment (TRL7).
- exploitation roadmap, outlining potential commercialization pathways, and next steps for scaling the solution.
- user validation study to assess the use case, engaging at least 5 individuals (users of the proposed solution e.g. operators, engineers, workers). Participants should agree to provide structured feedback on usability and technology acceptance, including the validation of the JARVIS tool with an option to share insights in relevant industry events or publications.

At the end of Sprint 3, beneficiaries must submit the assigned deliverable as proof of work completed including:

1) the final report with the achieved results including the outline for future exploitation and feedback to the impact assessment.
2) a publishable video from the system prototype demonstration in operational environment (TRL7).
3) a publishable summary of the achievements.

7.2 Evaluation during the programme

The milestones, KPIs and deliverables will be evaluated at the end of each Sprint. A remote review will take place after each phase to evaluate the progress of the beneficiaries.

The relevant KPIs and expected outcomes are gathered in the table below:

JARVIS overall KPIs for External Pilots	• KPI 1: Successful demonstration of the use case in the selected domain at TRL7. • KPI 2: Number of **JARVIS** tools utilized (1 or 2). • KPI 3: Operator acceptance level of >60% based on a user study with at least 5 users. • Select 2 from the KPIs below: • KPI-O1: Reduction of human exposure to harmful environments by 50% • KPI-O2: Reduction of reconfiguration and programming time by 30% • KPI-O3: Reduction of cycle time by 40% in average • KPI-O4: Improvement of ergonomic conditions by 15% reduction of ergonomics scores including RULA, OCRA, NIOSH, or similar.
Dissemination KPIs	• KPI 1: 1 Minimum 1 public announcement of the scope of the project (e.g., via Social Media (SM) - Sprint 1. • KPI 2: Minimum 1 prototype demonstration at TRL 6 or above (Sprint 2). • KPI 3: Minimum 1 prototype demonstration at TRL7 (Sprint 3). • KPI 4: Minimum 3 SM posts per each Sprint and 200 interactions in total (likes, shares, comments) across all posts during the programme. • KPI 5: One blog post for JARVIS website per Sprint
Expected final outcome	The expected outcome at the end of the 10-month project execution includes: - the demonstration of the solution including the **JARVIS** selected functionalities at a relevant environment with the selected use case (onsite or testbed). - a report presenting the testing with actual users in the selected industry. This should be supported by a user satisfaction study and documented in a report. - a report presenting their go to market strategy.

The sub-granted project must submit to the JARVIS consortium the deliverable(s)/report(s) corresponding to each Sprint by the last calendar day of the respective Sprint, unless otherwise indicated by the JARVIS consortium.

The review will be remote via a teleconference platform. The beneficiaries will present the work completed, outline the progress achieved, and answer questions from the JARVIS experts.

After the review, the beneficiaries will receive a review report, including short comments and potential recommendations. The report will indicate whether the deliverables are accepted, require revision, or are rejected.

Upon acceptance of the deliverables, the corresponding lump sum payment tranche will be approved. Payments will be processed within forty (40) working days following the positive review outcome.

In the event of a rejected deliverable or an unsatisfactory review, beneficiaries will be requested to re-submit improved deliverables. The JARVIS experts will then determine whether the project may proceed to the next Sprint or if the risk of failure is too high.

If rejection or an unsatisfactory review occurs in the final Sprint (Sprint 3), the JARVIS Consortium may allow a short extension for the beneficiary to revise and resubmit the deliverables. If the deliverables are approved within the extension period, the final lump sum payment will be released accordingly.

7.3 Participation in events

During the three Sprints, the selected beneficiaries should participate in events such as audio calls, video calls, webinars, online training, virtual conferences, etc. organized or suggested by the JARVIS Consortium.

7.4 Resources and tailored support provided within JARVIS Assistance Programme

JARVIS offers a comprehensive support package to support the External Pilots. In addition to the financial support of up to €130,000 per project, participants will benefit from tailored mentoring for the overall solution deployment, as well as expert guidance to integrate and deploy JARVIS digital tools that will complement the existing solutions in real-world scenarios.
Each selected project will be supported by a dedicated JARVIS Mentoring Team, ensuring that External Pilots maximize the potential of JARVIS digital tools while effectively implementing their solutions. The mentoring team includes:

- Innovation Mentor (IME): Main contact point between the External Pilot and the JARVIS project. The IME may provide inputs on innovation and technical aspects, and involve other resources from JARVIS, if necessary.
- SSH Mentor (SSM): Ensures that your solution is fit for market, user-centric, and aligned with societal and regulatory considerations, leveraging insights from social sciences and humanities (SSH).
- Industry Mentor (IND): Contribute with inputs from the overall sector of which the External Pilot operators (e.g., either Manufacturing or Inspection & Maintenance). Whether or not to

include an IND will be evaluated on a Pilot-to-Pilot basis, based on, e.g., the composition of the team in the External Pilot and the choice of Innovation Mentor.

To ensure fair and objective assessment, an Internal Evaluator (IEV) will independently evaluate project progress, offering valuable feedback while remaining uninvolved in day-to-day activities.

The Innovation Mentor (IME) will provide the External Pilot with a template, which will serve as a roadmap for monitoring milestones and results. Each External Pilot will undergo a minimum of three evaluation meetings, corresponding to key project sprints, ensuring continuous improvement and impact assessment. The document will be the main part of the "Review report" referred to in Section 5.2. Please see that section for further information about the evaluations.

8 CONCLUSION

This document summarizes the challenges of the Open Call along with the tools that will be accessible to the selected applicants of the 1st JARVIS Open Call. The applicants should consider the presented functionalities and involve at least one of the JARVIS tools in their proposals. The JARVIS consortium will guide and support the integration and deployment of the selected toolset in their use case. The feedback collected after the end of the projects' execution will drive further enhancements of the functionalities of the JARVIS modules.