1 Final publishable summary report

1.1 Executive summary

At worldwide level, the water is representing one of the main precious resource, with increasing consumptions with respect of its resources, therefore the water losses are urgent issues to take care of. At European level, recent studies have been performed and they estimate the water distribution networks losses to go around 30 to 40%, peaking to more than 50% in some Eastern European countries. It is clear that the economic impact and scarcity of public water sources mandate the development of a systemic leakage control program; while this would seem the most intuitive and feasible approach, currently no technology is reliable enough to be used to pinpoint every source of leak. It's therefore paradoxical that a large share of such a scarce and crucial resource gets wasted: this happens because a considerable part of the more than 2 million km of the European Water Distribution Network has been built under extremely outdated standards and construction practices, and with technologies that are no longer appropriate.

To solve this issue, the TRACT project will introduce to the market an advanced water pipe monitoring system, consisting in a transport mechanism containing sensors for leakage detection and pipe condition monitoring, which can navigate and inspect water pipe structures of various diameter without the necessary precondition of shutting down the process of water distribution.

This valuable output of the TRACT project will be made available to water utilities clients through the successful delivery of the following Scientific and Technological Objectives:

1) Sensor system along with sensor fusion algorithms, which allow the inspection robot to detect and locate pipe damages, leakages, and scaling;

2) Software for mapping the pipeline network;

3) Pipe entry mechanism for a "hot tapping" drilling process, which will allow the inspection robot to enter water pipes without the need for shutting the pipes down;

4) Transport mechanism, which can carry the sensor system and navigate through water pipes in the range of 100 mm – 600 mm, covering the dimensional range of the majority of existing water supply pipes.

The main goal in the TRACT project and of the entire consortium is to make available such a technology, helping this way, the European Water Utilities, hopefully the International Water Utilities as well, to be able to inspect the pipes networks, by inspecting and anticipating any eventual pipes breakages, which can lead to major water quantity losses.

The TRACT consortium is formed by the strong participation of 4 SME's: SubCtech GmbH (SUBC) and emma Technologies (EMMA) from Germany, Breivoll Inspection Technologies from Norway (BIT), and Topsonic UAB from Lithuania (TOP), 3 RTD's performers: Stiftelsen Sintef from Norway (SINTEF), Istituto Tecnologico of Aragon from Spain (ITA) and LABOR srl from Italy (LABOR), one enterprise end-user, Acqualatina Spa from Italy (ACQUA).

1.2 Summary description of the Project Context and Objectives

As per the project contract, the TRACT project has been devoted to attaining the following strategic goals with the activities performed under the specific 7 work packages, which were spread all along the duration of the two years project. From the **technical** side, the TRACT project was mostly devoted to achieve the following:

1. WP1 – the definition of the restrictions and constraints on the TRACT robot's structure and the establishment of the end-user and system requirements, including external requirements;
2. WP2 – the layout for the TRACT system with identification of system components and interfaces; specifically the ultrasound sensors selection, design and realization of the signal conditioning electronics for pipe condition monitoring; the design, realization and implementation of the pipe entry mechanism and the robot transport mechanism;
3. WP3 – The development of a robot navigation software, including mapping algorithms and integration of the already existing ART signal processing algorithms of the TRACT Pipescanner, owned by BIT;
4. WP4 – implementation of the of the specific modules in a pilot prototype to be tested and customization of the prototypes, not lastly the refinement of the prototype in order to obtain the final system.
5. WP5 – extensive testing and complete validation of the TRACT system, the evaluation of the user and professional acceptance; not lastly, the study of the economic benefits of the solutions for all the stakeholders involved.

The Dissemination activities and management of the Consortium (WP6 and WP7) were continuous activities during the project, and produced outputs that are detailed in the following sections of this report. Herein a synthesis of the objectives obtained under these two work packages:

6. The establishment of initial discussions among the partners aimed at identifying targeted **dissemination and exploitation actions** that the Consortium will put into practice for an optimal diffusion and promotion of the TRACT project, together with the collection of preliminary ideas that will be useful for the preparation of a specific Plan for Use and Dissemination of Knowledge document, at Month 9, indicating the approach that will be adopted after the end of project for the product commercialization;
7. The ideation, creation and maintenance throughout the project of the dedicated **dissemination channel**, such as the website with a dedicated logo, the first and a second press release of the project, as well as the updated communication material, such as poster and brochure.
8. Presence and updates on social networks and partner company's website of the project objective and activities.

Finally, let us consider the milestones list for the entire period of the project, reassumed in the table below:

- MS1, Requirements and Specification Matrix, to be delivered at M2, involving the WP1;
- MS2, TRACT hardware, at M9, involving the WP2;
- MS3, TRACT Software, at M12, involving the WP3;
- MS4, TRACT prototype, at M16, involving the WP4;
- MS5, Industrial validation of the TRACT system, at M24, involving the WP5.

Basic results have been fixed and achieved for the first period, as means of requirements and specifications of the system components, designs available of each TRACT subsystems, achieving this way

the first two Milestones, respectively **MS1 and MS2**, although the core objectives of the project have been concentrated in the second period with the achievement **of the remaining Milestones 3, 4 and 5**.