

Deliverable 4.1: Dissemination and Exploitation plan

Self-Healing Soft Robotics

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TABLE OF CONTENTS

SECTION 1 SHERO PROJECT EXECUTIVE SUMMARY	3
SECTION 2 OBJECTIVE OF THE DOCUMENT	4
SECTION 3 SHERO WEBSITE	5
3.1 Overview of the website	5
3.2 Website structure	5
SECTION 4 SHERO LOGO	7
SECTION 5 SHERO SLIDE TEMPLATE AND BANNER.....	7
SECTION 6 SHERO WEB 2.0 TOOLS: TWITTER	8
SECTION 7 FIRST PRESS RELEASE	9

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SECTION 1: SHERO PROJECT EXECUTIVE SUMMARY

The radical vision of the SHERO project is the ambitious development of fully-autonomous self-healing soft robotic devices, by integrating engineered functional materials, smart sensing and active actuation and control capabilities into soft robots. These soft robotic systems will be able to sense and evaluate loss of performance and heal damage due to fatigue, overloading, and injuries by sharp objects present in dynamic environments or by human contact. Such fully integrated self-healing robotic systems - and by extension other devices, machines and structures - are unprecedented in scientific literature.

This project will challenge the limits of current state-of-the-art research to fortify the foundations for all three pillars of mechatronic design: actuation, sensing and control, supported by advanced material design. Merged into prototypes and demonstrators, these fundamental principles are further refined in view of a synergistic development of more complex and autonomous robotic systems. The results of the project will reach further than the already broad field of robotics and automation. These concepts can be implemented in both dynamic and static applications and environments. The combination of material systems containing passive and active healing mechanisms with smart sensory capabilities could revolutionize automotive, aerospace and naval industries, on- and offshore energy production, manufacturing and construction sectors, illustrating the overarching impact of this pioneering technology on the development of more reliable and sustainable products, finding applications throughout society.

The breakthrough targeted in the project is the development of complete robotic systems that are able to feel pain (sense microscopic and macroscopic damage), react intelligently to relieve the pain (evaluate performance and prevent catastrophic failure), take the necessary measures to heal the damage and to restore all functions (induce or facilitate a controlled autonomous or non-autonomous healing of damaged elements), perform a rehabilitation (evaluate the quality of the healing process and take measures accordingly), and, finally, return to action. The unique, integrated design of SH capabilities in robotic systems with intelligent control will lead to lighter, more efficient, more reliable and more sustainable designs, as preventive and corrective healing will drastically increase the performance lifetime and reliability of such systems, even under unpredictable conditions. On the long term, the project will provide the fundamental insights and scientific developments to introduce performance evaluation and structural health monitoring, along with active control and intelligence to a much broader range of application domains.

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SECTION 2: OBJECTIVE OF THE DOCUMENT

The objective of this document is to report the activities carried out for the “Task 4.1 - dissemination and exploitation plan” in the framework of WP4 about the external dissemination means of the SHERO project. This document reports the activities related to:

- the design of the SHERO project website in Section 3;
- the design of the SHERO project logo in Section 4
- the design of the SHERO slide template and roll-up banner in Section 5;
- the design of the Web 2.0 tools for dissemination of the SHERO results in Section 6.
- the overview of the planned press release scheduled on August 7 2019 in Section 7.

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SECTION 3: SHERO WEBSITE

3.1 Overview of the website

The website of the SHERO project was designed by the University of Cambridge. The website uses the open source *Wordpress* for its content management. The official web address of the SHERO project is <http://www.sherofet.eu/>.

The official website is the primary channel for providing information about the to the scientific community, the national and European policy-makers, and the general public. As the project is still in its nascent stage, the details available now are limited to the project objective, state-of-the-art and relevant media publications.

The main goal of the website is to raise public awareness as well as to update the scientific community on the progress of the SHERO project. The website works in tandem with the Web 2.0 tool (Twitter account) for providing detailed and succinct information respectively. Each page of the website also contains link to the SHERO twitter account.

Internal documents meant for the consortium partners are shared through Microsoft *Sharepoint* organized by VUB, a web-based collaborative platform that integrates with Microsoft Office.

3.2 Website structure

The website contains the following sections and subsections (Figure 1):

- Home
- Project
- Team
- Resources
- Relevant Publications
- Media
- News
- Contact

With the progress of the SHERO project, the resources, publications, media and news page will be periodically updated. The website is also tracked with *Google Analytics* to gage the impact of the project and the dissemination strategies.

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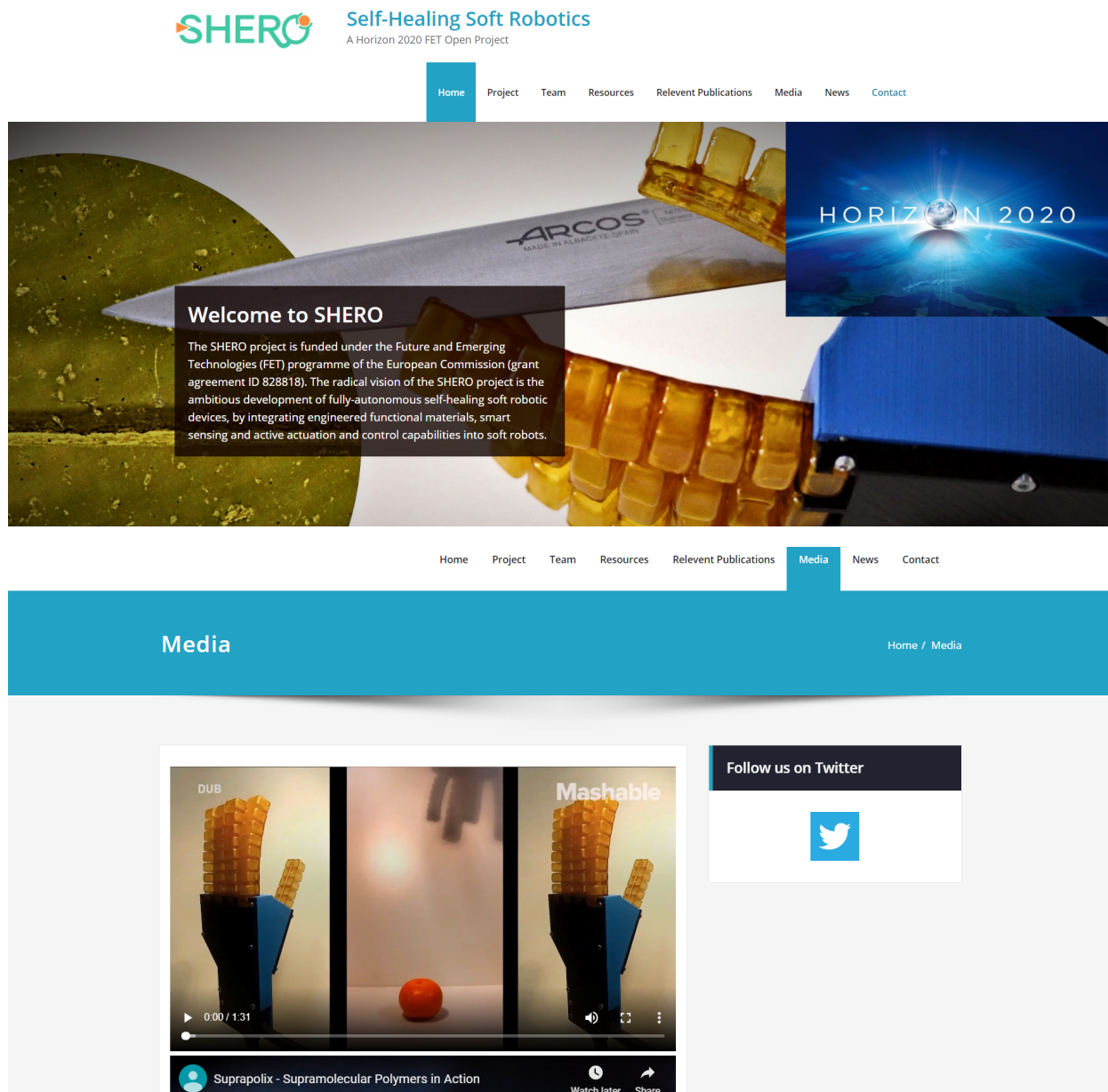


Fig.1. Overview of the website www.sherofet.eu.

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SECTION 4: SHERO LOGO



The SHERO logo has been developed in-house by VUB and incorporates symbolically the aim of the project. Several designs were proposed, the final decision was made by vote.

The colour green is used as it is the color of growth and rejuvenation, a theme that clearly corresponds to the self-healing ability of the robots that will be developed. The complementary orange is used to create accents. The combination of both colours represents the multidisciplinary nature (robotics and material science) of this project.

In the letter S, the triangle symbolizes damage that can occur to the material, while the O represents two grippers holding an object. The grippers are connected to a robot (the letter R) which is one of the main demonstrators that will be built. The symbol of the circle with C-shaped arms around is also a model frequently used to depict (reversible) bonds inside a material.

SECTION 5: SHERO SLIDE TEMPLATE AND BANNER

Together with the logo, a slide template has been designed (Fig.2.) that can be used for internal and external presentations. The template includes all logos of the partner institutions and the European Commission, the SHERO website and twitter handle for easy reference.

The same visual elements are visible in the roll-up banner (Fig.3.), together with some images on self-healing materials and robots. The banner will be set up at events to increase visibility.



Fig.2. The slide design to be used for internal and external presentations.

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Fig.3. The roll-up banner at the VUB lab.



SECTION 6: SHERO WEB 2.0 TOOLS: TWITTER

The SHERO Consortium has created a new Twitter account for the project. An overview of the homepage of the SHERO Twitter account is shown in Figure 4. The name of the new account is SHERO, and it can be reached by using the following Twitter address: @SHERO_FET.

The main goal of the Twitter account is to provide a quicker and more frequent updates on the project to the general public, the scientific community, the partners in the consortium and the European policy-makers. The Twitter account also serves as a medium to connect with other projects and researches relevant to the project.

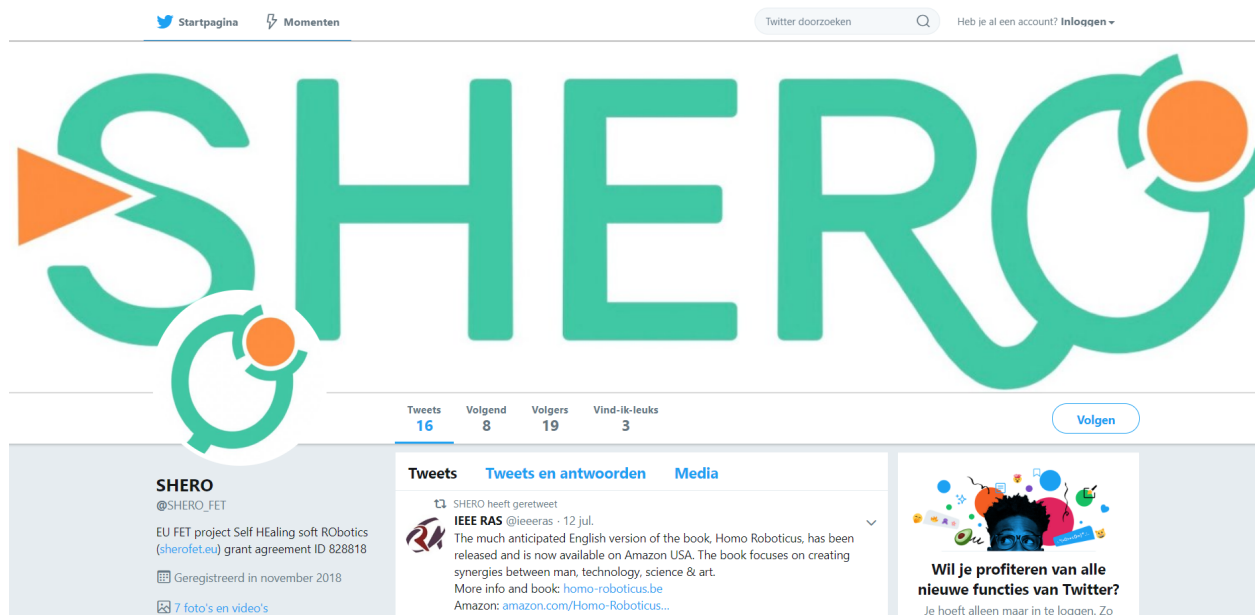


Fig.4. Overview of the SHERO twitter account

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SECTION 7: FIRST PRESS RELEASE

The SHERO consortium is planning an initial press release on August 7th to kickstart the beginning of the project and increase public enthusiasm. The idea behind having an early August press release is to leverage the typical inactive in the news media during August. Each project partner will coordinate with their own marketing team to disseminate the project. The articles are sufficiently supplemented with pictures and videos to make the articles more attractive for publication. The draft of the press release is provided in the appendix.

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APPENDIX: PRESS RELEASE DRAFT

Press release Vrije Universiteit Brussel

VUB, University of Cambridge, ESPCI, Empa and SupraPolix receive 3 million Euro in European support for groundbreaking research into self-healing robots

This support is provided in the framework of the "Future & Emerging Technologies" programme of the European Union

Robots are playing an increasingly bigger part in our daily life and work. Over the next three years, researchers from the Vrije Universiteit Brussel, University of Cambridge, École Supérieure de Physique et de Chimie Industrielles de la ville de Paris (ESPCI-Paris) and Swiss Federal Laboratories for Materials Science and Technology (Empa) will be working together with the Dutch Polymer manufacturer SupraPolix on the next generation of robots: (soft) robots that ‘feel pain’ and heal themselves. The partners can count on 3 million Euro in support from the European Commission.

Soon robots will not only be found in factories and laboratories, but will be assisting us in our immediate environment. They will help us in the household, to reduce our workloads and to make our lives safer. Robots will work side-by-side with us and it is important that this is done in a safe way. In order to enable manipulation of fragile objects with dexterity and to guarantee people’s safety, many next generation robots are built from flexible materials. Because they are soft, they can’t hurt people. But this, at the same time, means that these ‘soft robots’ are particularly vulnerable to cracks caused by sharp objects that are present all around us. The repairs which are needed to get those robots back to work often take time and are therefore very pricey.

To avoid this, the scientists will develop technologies within the new SHERO project that allow soft robots to self-heal damage. Because this repair process should not involve humans, the researchers are looking into self-healing materials to build the soft robots with. These flexible plastics can completely heal themselves when they are damaged. Imbedded functional material will assist to sense and actuate the self healing process. The ambitious goal of the European project is to create a soft robot made from a self-healing material, which can detect damage, take the necessary steps to (temporarily) heal the defect, provisionally as to complete the work in progress, or more completely during the service operation.

This prestigious project is led by the University of Brussels (VUB) with a team of scientists of the robotics research centre Brubotics and the polymer research lab FYSC. Prof. Vanderborght, managing the project, explains: *“We are obviously very pleased to be working on the next generation of robots. Over the past few years, we have already taken the first steps in creating self-healing materials for robots. With this research we want to continue and, above all, ensure that robots that are used in our working environment are safer, but also more sustainable. Due to the self-repair mechanism of this new kind of robots, complex, costly repairs may be a thing of the past.”*

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Dr Thomas George Thuruthel, Research Associate in Soft Robotics Sensing and Self-Healing at the Department of Engineering, University of Cambridge: *"We will be using machine learning to work on the modelling and integration of these self-healing materials, to include self-healing actuators and sensors, damage detection, localisation and controlled healing. The end goal is to integrate the self-healing sensors and actuators into demonstration platforms in order to perform specific tasks."*

Empa in Switzerland will focus on new flexible sensors and actuators, which can be embedded into the self-healing polymers. Dr Frank Clemens, Group leader at the Laboratory for High Performance Ceramics, Empa: *"In a first step we will embed our piezoresistive soft material sensor fibres in the self-healing polymer to sense continuously the strain and to detect the region where self-healing process has to be activated. In later step other kind of sensor and actuators will be integrated, depending on the final application"*.

ESPCI-Paris, where the first self-healing elastomeric materials were created, participates in the project. *"We are excited to be part of this ambitious research project at the crossroads between soft matter physics, materials chemistry and information science." Soft robotics is an excellent opportunity for involving new materials"*.

Dr Bosman of SupraPolix: *"We feel privileged to be a partner in this consortium of Europe's top research groups on soft robotics. We are convinced that our self-healing materials can bring this field to the next level, thereby creating value for SupraPolix, robotics, and the community at large."*

For more information, please contact:

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About Future & Emerging Technologies (FET):

Maybe the visionary aspects and exploratory characteristics of FET sound like a kind of magic, but the mission of FET is actually very concrete: to convert Europe's excellent scientific knowledge and research into a competitive advantage.

It is expected that FET projects will bring about radical technological innovations through innovative collaborations between multidisciplinary science and pioneering engineering. It will help Europe to take the lead at an early stage in these promising future technology areas that are able to refresh the basis for future European competitiveness and growth, and make a difference for society over the next few decades.

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