NEWSLETTER#1

June 2023

Editorial

Dear readers,

SIMAR is a three-year project, sponsored by the European Commission's Horizon Europe programme, which focuses on the creation of robotic solutions for Inspection and Maintenance (I&M).

We bring you the first SIMAR newsletter that will cover the presentation of the project. During the following pages you will find the motivation that triggered the realization of the project, the main challenges on operation in the Oil&Gas sector, the objectives to fulfil.

In addition, we will introduce the main use cases and, of course and our great consortium that will be in charge of the optimal development of the project. From now on, we will keep you updated on the project's development and activities.

If you want to keep up to date with SIMAR's news, visit our website, subscribe to our Newsletter and don't forget to follow us on our social networks!

We hope you enjoy reading the first newsletter of the SIMAR project.

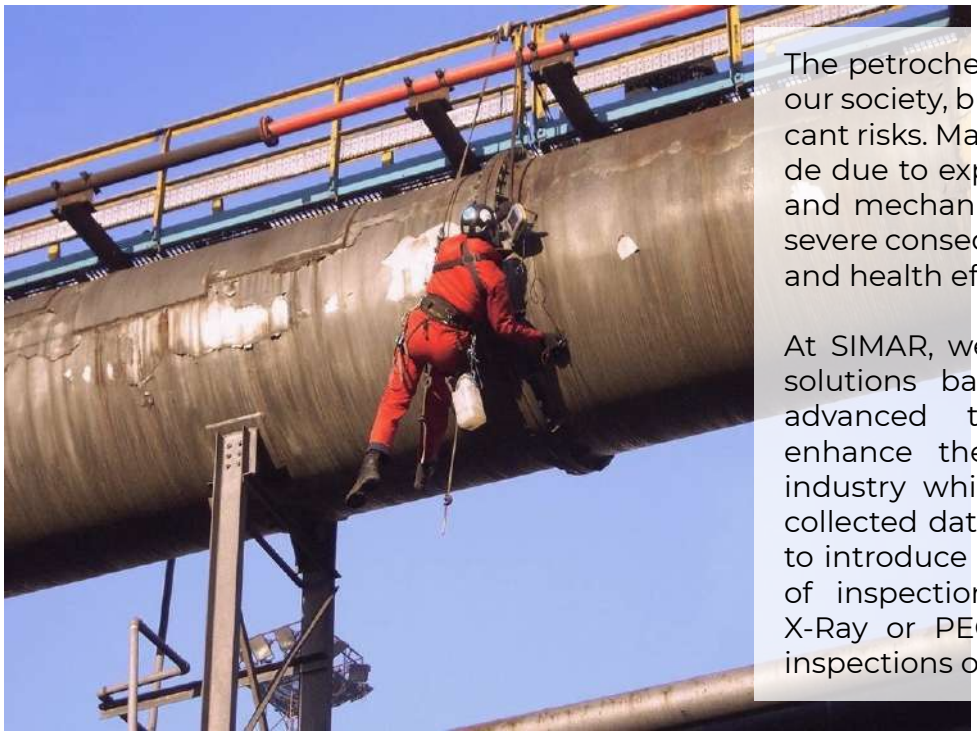
Your feedback and comments are always welcome!

Yours faithfully,

The Consortium

Project Presentation

Motivation



The petrochemical industry is a vital sector for our society, but it is also associated with significant risks. Materials in Oil & Gas facilities degrade due to exposure to products, environment, and mechanical demands, which can lead to severe consequences such as fatalities, injuries, and health effects on the public and plant staff.

At SIMAR, we believe that developing digital solutions based on robotics and AI-based advanced technologies can significantly enhance the safety of the petrochemical industry while improving the quality of the collected data and information. We are proud to introduce our latest innovation, a new type of inspection robot that integrates Visual, X-Ray or PEC sensors to perform complete inspections of insulated pipes.

Insulated pipes In Petrochemical infrastructures pose a significant challenge to the industry as every pipe must be inspected regularly, and insulated pipes make this process more difficult as the insulation covers possible defects. To address this challenge, we have developed a sophisticated robotic system that can safely land on pipes, even if they are located in complex locations and deploy light-weight crawlers to perform complete inspection of insulated pipes.

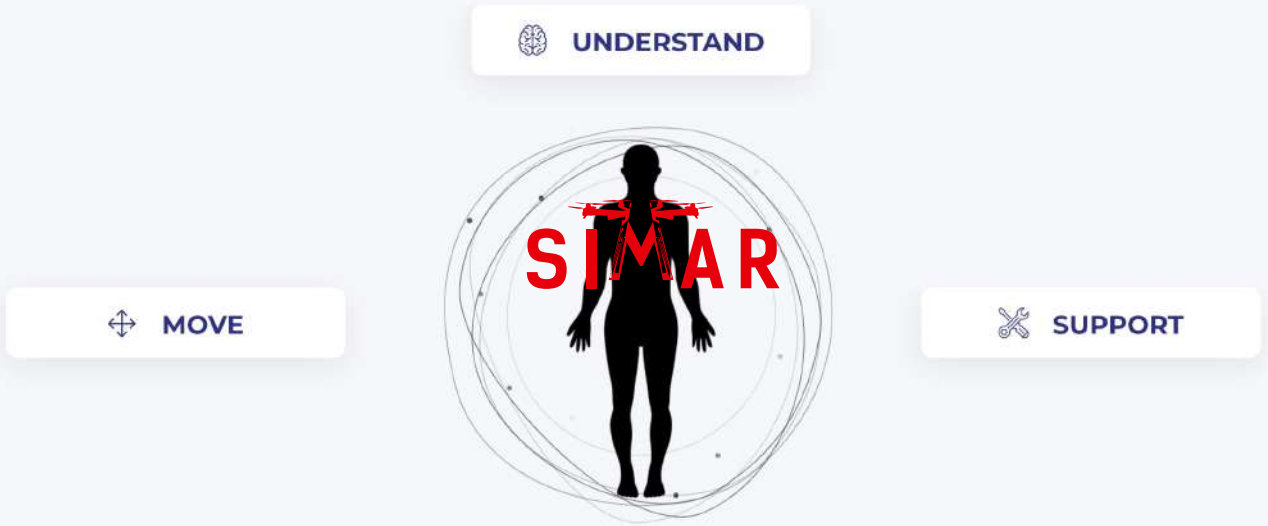
This system is composed of an aerial system with advanced navigation capabilities that can locate and land o pipes, making inspections quicker, more accurate, and safe for workers.

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No 101070604

Intelligent Functionalities

SIMAR's primary goal is to keep employees of hazardous industrial facilities in areas where inspection and maintenance tasks may be carried out in a way that is both safe and healthy.

This will be achieved by implementing the MOVE, SUPPORT, and UNDERSTAND functionalities, integrating them into a special system, validating it in a controlled environment, and finally demonstrating it in a real operational industrial facility of the SIMAR end-users.



MOVE

will be implemented by robots with flying and crawling locomotion.

SUPPORT

by the application of Augmented Reality.

UNDERSTAND

by means of Artificial Intelligence.

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The Technological Challenge: A new approach

Within SIMAR, the following technological challenges will be addressed:

- Novel robotic inspection systems for the petrochemical industry.
- Autonomous navigation in complex environments.
- Augmented reality applied to robotic-based inspections.
- Remote and automatic visual inspection of insulation pipes.
- Integrate adapted X-Ray or PEC sensors to perform complete inspections of insulated pipes.

CHALLENGES

A single petrochemical facility includes more than 50.000 inspection points since every pipe must be inspected regularly. Due to the insulation, these pipes cannot be scanned with ultrasonic sensors and require more advanced inspection techniques such as X-ray and Pulsed Eddy Current (PEC).

SIMAR claims to be overcoming this problem, yet faces the following key challenges:

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Challenge 1

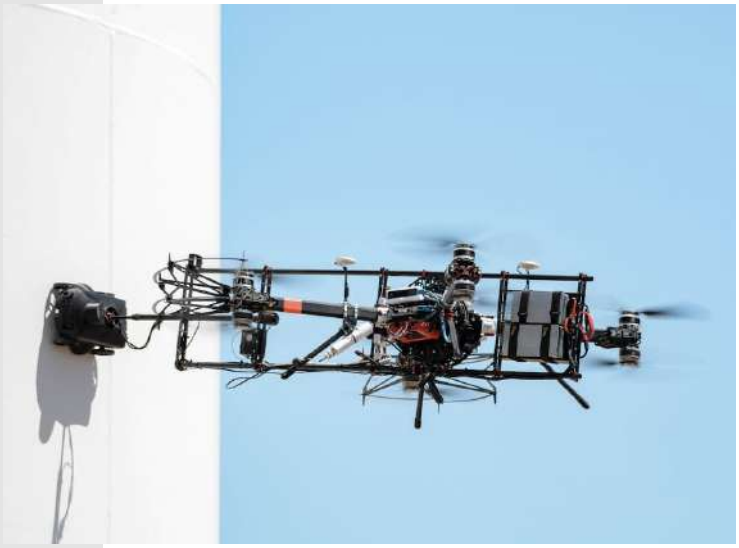
Reduce the risk and therefore increase the safety of personnel when collecting inspection data.

Human personnel will be needed to visit all inspection locations in situ because of this unique remote inspection technology. They can avoid dangerous jobs at heights or with high temperatures. As a result, risk exposure is reduced, and human safety is enhanced.

Challenge 2

Increase the quality of the data by reducing human factors that affect their performance.

Remote inspection, as well as avoiding working in difficult, dangerous, and uncomfortable environments (at height, temperature), will limit the human elements that might lead to human errors in inspection data collection. More trustworthy inspection data is critical for ensuring asset integrity and avoiding catastrophic asset failure in the future.



Challenge 3

Reduction of current inspection costs and outage time.

Errors or poor inspection data quality will have serious consequences, including fatalities, injuries, and health repercussions on the general public and plant employees. It may also allow for leakage and the release of hazardous materials into the environment, resulting in costly clean-up and cleanup. SIMAR's usage of robotic technologies will significantly reduce the cost and time of inspection and maintenance activities in oil and gas plants.

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OBJECTIVES

In order to overcome the above challenges, SIMAR will pursue four objectives. The first is related to the MOVE functionality. The second involves SUPPORT and UNDERSTAND. The third deals with the human-centered characteristic, and finally, the fourth targets validation and demonstration.

Objective 1:

Multipurpose aerial/ground robotic system to keep away workers from dangerous situations for a safe, robust, and trusted inspection.

Objective 2:

Artificial Intelligence and Augmented Reality systems to reduce human workload and level of stress.

Objective 3:

Human-centered robotics inspection system.

Objective 4:

TRL7 validation and demonstration on an operational petrochemical facility taking into account end-users' requirements.

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Uses cases

The complete robotic system will be able to perform a full and trusted inspection of insulated pipes with first a general visual inspection, followed by a Corrosion Under Insulation (CUI) inspection using tangential X-Ray of the selected insulated pipes and, finally, a detailed C-Scan Pulsed Eddy-Current inspection of specific parts of the insulated pipe.

Visual Inspection

The automatic visual inspection of insulation pipes involves detecting defects at a specific location on the pipe, without considering the type of defect. The challenges include limited or imbalanced training data and potential domain shifts. To address these issues, SIMAR partners will use one-class classification and domain adaptation in model optimization.

The trained model will take into account viewing conditions and insulation materials to ensure accurate performance. Confidence metrics and explainable AI methods will also be integrated to verify the model's accuracy. With SIMAR partners' expertise and methodologies, the automatic visual inspection of insulation pipes can be achieved with high precision and efficiency.

PEC (Pulse Eddy Current)

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X-Ray

The X-Ray crawler is a robotic system designed to inspect pipes for corrosion. The system is deployed to the bottom of the pipe to perform a tangential inspection. It is a mechatronic system that will be used on pipes of any size. The X-Ray generator is battery-powered and does not contain any radioactive materials, making it safer for workers.

X-Ray images are processed using deep learning algorithms to detect and classify corrosion defects. The inspection interface also integrates other types of data, such as visual information and X-Ray images, to provide a comprehensive analysis of the pipe's condition. This helps detect potential issues early, reducing downtime and costs.

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Introduction of the consortium

Andalusian Foundation for Aerospace Development (FADA) is a non-profit organization that monitors the CATEC research center. The primary objective is R&D on technology connected to aerospace in collaboration with businesses, academic institutions, and other research facilities. FADA-CATEC has a great amount of experience creating solutions and applications with aerial robots and has more than 20 researchers working especially on aerial robotics technology.

The Aristotle University of Thessaloniki (AUTH), the sixth oldest and among the most highly ranked tertiary education institutions in Greece, is the largest university in Greece and in the Balkans. AUTH will participate in the project through the Department of Informatics' AIIA CVML R&D group.

Since its founding in 2011, QUASSET has established a solid reputation in the inspection and maintenance industry. It has taken part in more than 100 innovative initiatives, including the ongoing EU-funded H2020 PILOTING project. Additionally, QUASSET promotes development of innovative asset integrity management and condition assessment solutions for a variety of industries, including water, energy, infrastructure, chemical, and oil & gas.

A division of Chevron Corporation, **Chevron Oronite** is a renowned developer, producer, and marketer of lubricant and fuel additives and chemicals. Chevron Corporation owns and operates a plant in Le Havre, France. In its global organization, which consists of three regional operations with sales networks that reach local markets, Oronite employs more than 2,000 individuals.

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VES is a company that specializes in providing safe works at heights, with expertise in industrial inspection and maintenance. VES are pioneers in using drones for industrial and risk installations, allowing them to provide information on key equipment without the need for shutdowns.

The University of Seville (USE) is a prestigious institution in Spain that will participate in the SIMAR project through the GRVC Robotics Lab, which has more than 75 professors, researchers and engineers. This group is an international reference in aerial and unmanned robotics systems, participating in several national and international projects related to these fields.

BASF, the largest chemical company in the world, is playing a key role in the SIMAR project as an asset owner and operator. BASF Antwerp, one of the company's largest sites, hosts more than 50 different chemical plants and has over 500 km of internal pipelines on its pipe racks and underground. With over 3500 employees, BASF is constantly seeking innovative manufacturing practices, including maintenance and inspection.

Invited Project

AERO-TRAIN is a Marie-Sklodowska-Curie Innovative Training Network (ITN) - European Training Network (ETN) project.

The AERO-TRAIN partnership aims to become the first research-based training project in Structural Health Monitoring & Repair with aerial robots in the current European Higher Education Area by exploiting the robotics and AI strengths existent in Europe.

Our goal is to develop a new generation of Early Stage Researchers (ESRs) who will be leaders in the field of aerial robotic technologies for inspection and maintenance.

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Dissemination material

Here you can find our dissemination channels and social network profiles:

For the dissemination of the development of the project, the consortium has created a SIMAR LinkedIn profile and also a Twitter profile to keep you up to date of the latest news of the project.

Hope you find these interesting!

WEB
https://simar-project.eu/

LINKEDIN
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TWITTER
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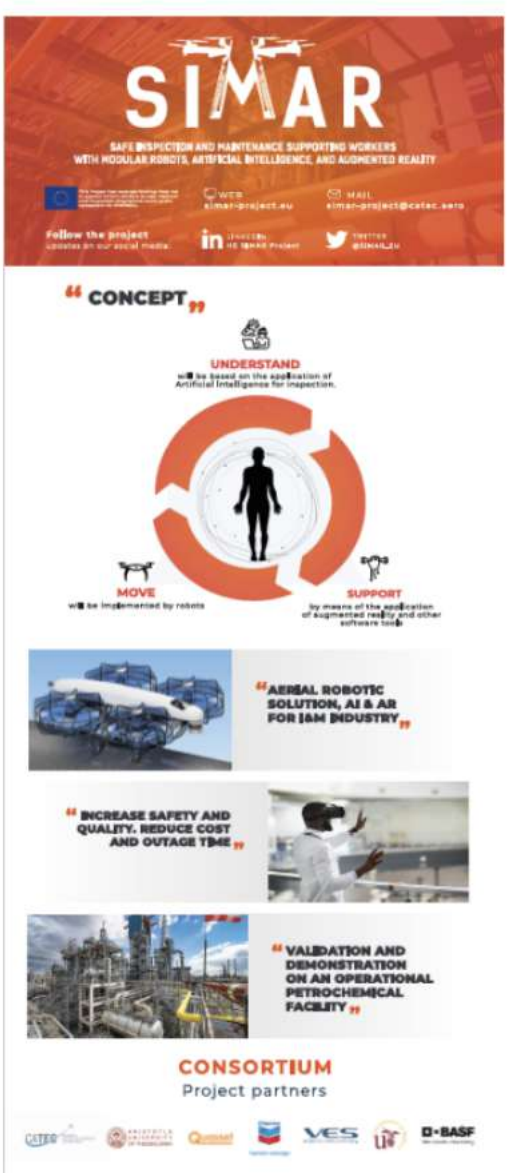
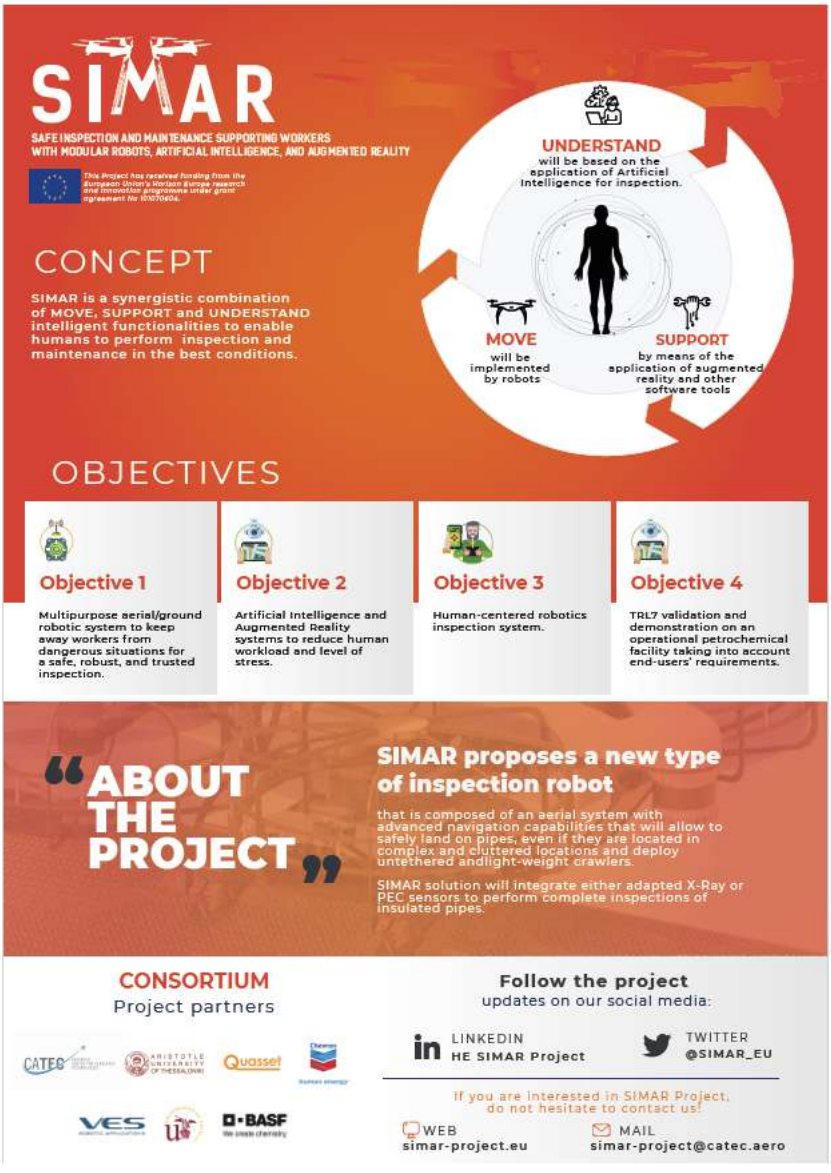
We present you our Poster, Roll-Up and the flyers designed for the communication activities of SIMAR too!





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SIMAR CONCEPT

SIMAR is a synergistic combination of **MOVE, SUPPORT and UNDERSTAND** intelligent functionalities to enable humans to perform inspection and maintenance in the best conditions.

simar-project.eu

UNDERSTAND
will be based on the application of Artificial Intelligence for inspection.

MOVE
will be implemented by robots

SUPPORT
by means of the application of augmented reality and other software tools

SIMAR
SAFE INSPECTION AND MAINTENANCE SUPPORTING WORKERS WITH MODULAR ROBOTS, ARTIFICIAL INTELLIGENCE, AND AUGMENTED REALITY

SIMAR

CONSORTIUM
Project partners

Chevron human energy · Quasset · CATEC · UL · BASF We create chemistry · VES · Aristotle University of Thessaloniki

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MOTIVATION

Safety and health

Materials degrade in Oil&Gas facilities due to exposure to product, environment, and mechanical demand. In petrochemical facilities, errors in the inspection process have severe implications, including fatalities, injuries, and health effects on the public and plant staff.
It may also allow for leaks and the release of dangerous compounds into the environment, resulting in clean-up and remediation costs.
Developing digital solutions based on robotics and AI-based advanced technologies **will drastically improve the safety of the petrochemical industry while improving the quality of the collected data and information.**

SCOPE OF APPLICATION

Insulated pipes in Petrochemical Infrastructures

A single petrochemical facility includes more than 50.000 inspection points since every pipe must be inspected regularly. Insulated pipes make this process more difficult as the insulation covers the possible defects. Then, more complex system than ultrasonic sensors, such as X-ray and Pulsed Eddy Current (PEC), are required.

PURPOSE

Intelligent Functionalities in I&M

SIMAR proposes a new type of inspection robot that is composed of an aerial system with advanced navigation capabilities that will allow to safely land on pipes, even if they are located in complex and cluttered locations and deploy untethered and light-weight crawlers. SIMAR solution will integrate either adapted X-Ray or PEC sensors to perform complete inspections of insulated pipes.

CHALLENGES

Challenge 1:
Reduce the risk and therefore increase the safety of personnel when collecting inspection data, which normally involves works at height or with high temperatures. Therefore, the exposure to risk is decreased, and human safety is improved.

Challenge 2:
Increase the quality of the data by reducing human factors that affect their performance. Performing inspection remotely will reduce the human factors that can lead to human errors in collecting inspection data.

Challenge 3:
Reduction of current inspection costs and outage time. The use of robotic technologies in SIMAR will importantly decrease cost and time of inspection and maintenance operations in Oil&Gas facilities.

OBJECTIVES

Objective 1:
Multipurpose aerial/ ground robotic system to keep away workers from dangerous situations for a safe, robust, and trusted inspection.

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Links RRSS

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CONSORTIUM

Project partners

Chevron human energy

Quasset

CATEC ADVANCED CENTER FOR AEROSPACE TECHNOLOGIES

UNIVERSIDAD DE SEVILLA

BASF We create chemistry

VES ROBOTIC APPLICATIONS

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