The ROBINS project

ROBINS
ROBotics technology for INspection of Ships

ROBINS (ROBotics technology for INspection of Ships) is a collaborative project co-funded by the European Commission within the Horizon 2020 EU Research and Innovation programme. It is a 3 years project started the 1st January 2018.

The project aims at filling the technology and regulatory gaps that today still represent a barrier to the adoption of Robotics and Autonomous Systems (RAS) in activities related to inspection of ships. The technology gap is mainly related to the capability of RAS to provide at least outcomes equivalent to those obtained by traditional procedures. On the other side, the regulatory gap is mainly related to the possibility to verify such equivalence.

In this view, ROBINS assumes that the following requirements should be satisfied:

- Sensing and probing capabilities of RAS are at least as good as the corresponding human personal, direct, sensory experience, or provide equivalent or richer information
- RAS have the capability to access and adequately explore confined spaces where the inspection is required or desirable, including the capability to detect or devise its own position and orientation, and hazardous, harsh or dirty conditions can be found
- RAS performance in terms of safety, functionality, dependability and economic viability can be measured, assessed and verified in the required operational scenarios
- The data collected during inspection activities can be securely acquired, transmitted, archived, maintained and used, with special concern to confidentiality, integrity and availability
- The data collected during inspection activities, such as photographs, movies or thickness measurement data, are made available to end users by means of software tools capable of providing detailed information with adequate presentation and analysis capabilities

Two main types of operational scenarios are considered in ROBINS, which are representative of the two environments where costs and risks connected to inspection activities are more significant:

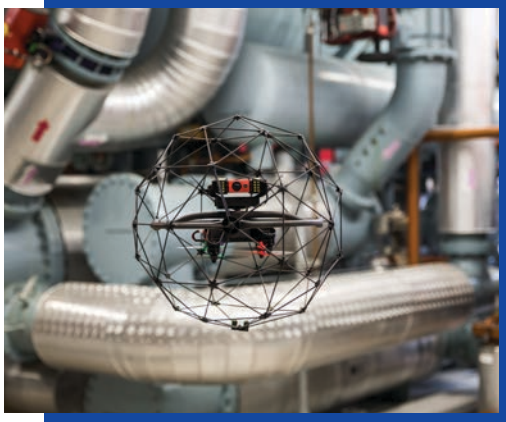
- Wide volumes with a reduced number of obstacles and irregular surfaces, like cargo holds and cargo tanks
- Very irregular, narrow, obstacle-rich spaces, like ballast tanks, forepeaks, cofferdams, etc

The requirements deriving from the two aforementioned operational scenarios are met by two different aerial drones, with different features and capabilities:

- A collision-tolerant flying robot, designed for industrial inspection, allowing access to complex, cluttered indoor places
- An advanced copter with rich equipment of sensors and software technology for highly autonomous unsupervised navigation, able to explore wide spaces according to complex path planning

Tasks related to thickness measurements and other probing activities are carried out by a magnetic crawler, which is intended to be used mainly in regular spaces, where its capabilities can be exploited at best, achieving good performance and cost effectiveness. CAD and image processing software tools play a key role in the RAS-assisted inspection loop and therefore their development is another main objective of ROBINS. The software is expected to:

- Devise a 3D numeric model of the confined space subject to inspection by means of image processing algorithms capable of combining together 2D pictures, and/or by means of meshing algorithms capable to devise textured meshes from point clouds and photographs



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- Provide virtual tours of the space subject to inspection. The user should be given the possibility to examine accurately the details of interest by moving in the 3D virtual space and setting the orientation of its viewpoint according to his need, and having always a detailed rendering of the surface observed consistent with the viewpoint
- Provide the possibility to add hotspots and/or associate additional information to selected parts of the 3D model (augmented virtual reality model)
- Identify critical or suspect areas from the analysis of visual data acquired during the inspection and highlight such areas in order to provide a valuable guidance to the surveyor

The fitness of RAS platforms for their intended purpose is assessed in ROBINS by means of the design, implementation and execution of a set of tests, carried out in a dedicated, specifically designed Testing Facility.

The possibility to test RAS platforms in a controlled and easily accessible environment, where repeatable test protocols can be implemented, considerably increases the development opportunity for new platforms and significantly reduces the costs related to the assessment of their capabilities and to the certification activities, when needed.

Field trials campaigns are also carried out to assess the reliability, coverage and effectiveness of testing protocols implemented in the Testing Facility, comparing the results obtained in the Testing Facility with those obtained in equivalent trials on-board.

The development of robust technical solutions for RAS-assisted ship inspection, based on the understanding of the challenges being faced by asset owners, is expected to streamline wide scale adoption of RAS technology in marine industry.

The final framework of tests, procedures, criteria and metrics can be easily turned into a common, objective, widely accepted regulatory framework for the assessment of RAS for ship inspection, in accordance to the IACS Recommendation 42.

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