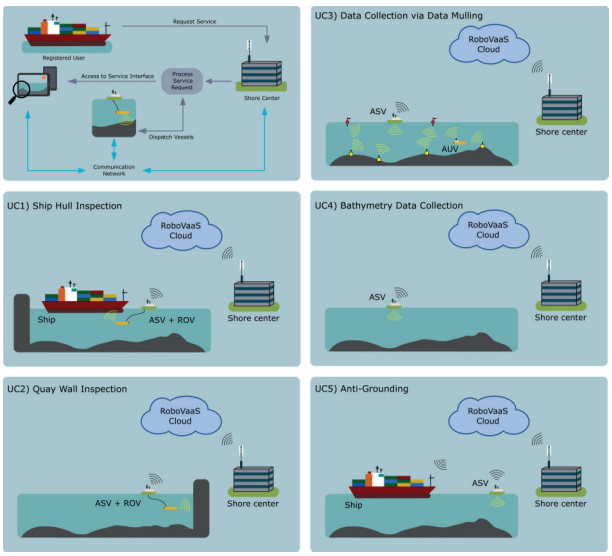

The goal of the RoboVaaS project is to revolutionise shipping and near-shore operations by offering on-demand robotic aided services via unmanned surface (USVs) as well as remotely and autonomously operated underwater vessels (ROV and AUVs). The concept consists of a network of unmanned vessels, innovative sensor technologies, a comprehensive communication network and real-time web applications. The main project objective is to demonstrate the concept.

The project includes the following phases: 1) Design, 2) Specification, 3) Individual developments and Testing, 4) Implementation, 5) Demonstration, 6) Evaluation, and 7) Validation and Marketing.

Within phase 1, the consortium designed five use cases under consultation of experts and stakeholder to answer current needs in the maritime field:

UC1) Ship Hull Inspection

A USV with a tethered ROV that scans an area of a ship hull for fouling and abnormalities in real sea trials. The underwater ROV will inspect the ship hull with a scanning laser system while the USV manoeuvres in a way to optimise the inspection process. The use case will focus on demonstrating the inspection process by means of at large scale ROV.

UC2) Quay Wall Inspection

An ROV tethered to an USV inspect a quay wall for strength and other material properties. This use case will take place in a small-scale setup by using proprietary system but allowing demonstrating the entire RoboVaaS service chain from request via dispatch of vessels to service execution.

UC3) Data Collection via Data Mulling

An AUV/USV will collect environmental data from submerged sensor nodes via acoustic underwater communication. Demonstration will take place at small-scale level with overarching goal of further developing low resource underwater communication inevitable for future RoboVaaS services.

UC4) Bathymetry Data Collection

A small-scale USV equipped with an echosounder will collect bathymetry data. This enables cost-efficient autonomous bathymetry survey of waterways.

UC5) Anti-Grounding

A USV equipped with a high-resolution sonar travels ahead of a vessel that requests the service and send real-time high-quality bathymetry data to prevent grounding. This use case will be simulated in a virtual full-scale scenario and validated by end-user (nautical officer).

Within phase 2, University of Padova and smartPORT focused on the communication networking protocol selection. The feasibility of each RoboVaaS use case was analysed. After defining the required amount of data to be transmitted and its desired transmission latency, the most suitable communication technology has been selected, according to both a literature survey and a simulation analysis. SonarSim focused on definition of minimum viable solutions for the automated single beam echosounder USV prototype for UC5 and simulation interface for UC5.

Within phase 3, Kraken designed a new laser head supporting around 100 times higher SNR in comparison to a standard SeaVision system without requiring changing the laser output power in order to fulfil requirements for a shallow water laser system for ship hull and quay wall inspections. Fraunhofer CML adapted their USV in order to demonstrate UC2-4: A sonar, an ROV and an environmental sensory platform was integrated to the USV. They further started developing a dispatch system for the ROV, the RoboVaaS real-time web application and an anti-grounding application. SmartPORT carried out fundamental research on the feasibility, efficiency, and resilience of underwater acoustic communication and developed novel algorithms. They prepared and performed initial tests for UC3.

In order to allow for smooth integration and demonstration for the future phase 4 and 5 HPA, CRIS and CML started preparations and defined scenarios.

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RoboVaaS

Robotic Vessels as-a-Service

PROJECT FACTS

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Consortium

* Fraunhofer Center for Maritime Logistics and Services
* Kraken Robotik GmbH
* University of Padova (SIGNET)
* Hamburg University of Technology (smartPORT)
* SonarSim
* University of Limerick (CRIS
* Hamburg Port Authority

Duration

06/2018 - 05/2021

Budget

Total Cost 1.8 M€
Funding 1.5 M€

funded by