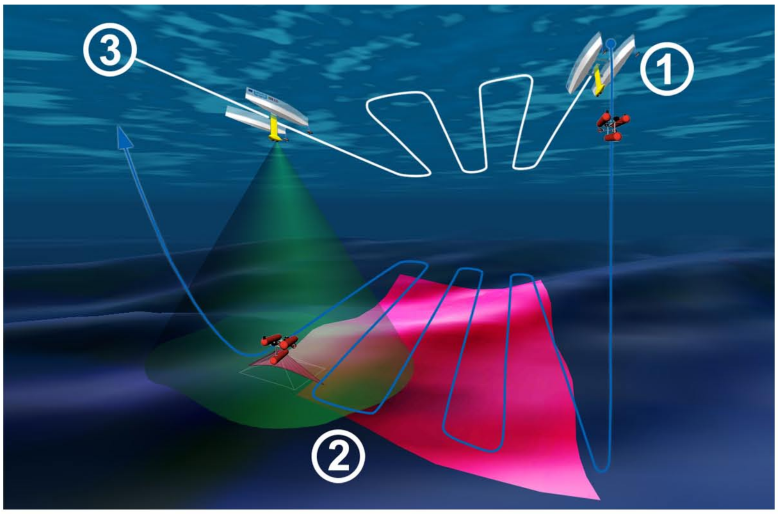
TRIDENT

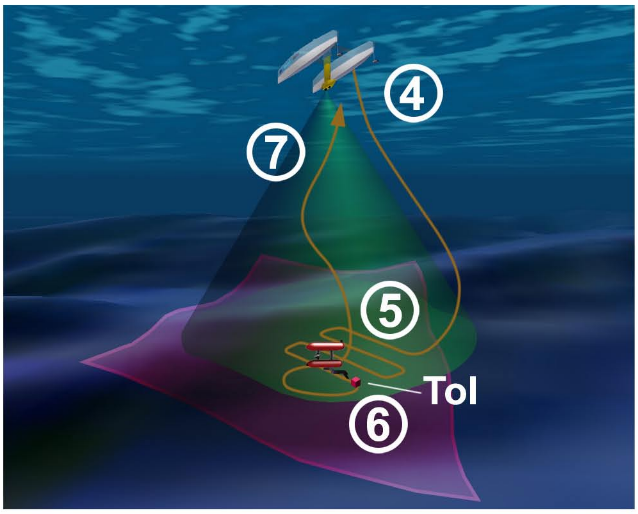
Marine Robots and Dexterous Manipulation for Enabling Autonomous Underwater Multipurpose Intervention Missions

SEVENTH FRAMEWORK PROGRAMME

Project information

This project proposes a new methodology to provide multipurpose dexterous manipulation capabilities for intervention operations in unknown, unstructured and underwater environments. In the TRIDENT project, a multipurpose generic intervention is composed of two phases:





PHASE I (Survey): The Autonomous Surface Craft (ASC) is launched to carry the Intervention Autonomous Underwater Vehicle (I-AUV) towards the area to be surveyed. Then, the I-AUV is deployed (1) and both vehicles start a coordinated survey path (2) to explore the area. The ASC/I-AUV team gathers navigation data for geo-referencing the measurements (seafloor images and multibeam bathymetry profiles). Finally, the I-AUV surfaces (3) and contacts to the end user to set-up and acoustic/optical map of the surveyed area. Using this map, the en user selects a target object (an object of interest) as well as a suitable intervention task (grasping, hooking, etc...).

PHASE II (Intervention): After selecting the target, the ASC/I-AUV team navigates towards the target position. Then, the ASC performs dynamic position (4) while keeping the I-AUV inside the USBL cone of coverage. Then, the I-AUV performs a search (5) looking for the Target of Interest (ToI). When the object appears in the robot field of view, it is identified and the I-AUV switches to free floating mode using its robotic arm as well as the dexterous hand to do the smart manipulation (6). Finally (7), the I-AUV docks to the ASC before recovery.

Project objectives

- Cooperative navigation techniques to achieve robust, high accuracy navigation (localization) of all the vehicles involved in the robotic team.
- Innovative mapping algorithms to robustly build consistent multi-modal maps of the seafloor.
- Guidance and control algorithms for the team vehicles alone but also to cooperatively guide and control both vehicles in formation.
- Embedded knowledge representation framework and the high-level reasoning agents required.
- Advanced acoustic/optical image processing algorithms to allow for feature detection and tracking.
- A redundant robotic arm endowed with a dexterous hand as an enabling technology for multipurpose manipulation underwater.
- Innovative strategies for the coordinated control of the joint AUV-Manipulator system.
- The mechatronics as well as the perception/action capabilities needed to face the autonomous docking of the I-AUV to the ASC.
- A multisensory control architecture, including a knowledge-based approach, to guarantee the suitable manipulation actions for enabling a multipurpose intervention system.

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