

Innovative R.E.A. tools for integrated bathymetric survey

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The REA (Rapid Environmental Assessment) concept is a methodology finalized to acquire environmental information, process them and return in standard paper-chart or standard digital format. Acquired data become thus available for the ingestion or the valorization of the Civilian Protection Emergency Organization or the Rapid Response Forces.

The use of Remotely Piloted Aircraft Systems (RPAS) with the miniaturization of multispectral camera or Hyperspectral camera gives to the operator the capability to react in a short time jointly with the capacity to collect a big amount of different data and to deliver a very large number of products.

The proposed methodology incorporates data collected from remote and autonomous sensors that acquire data over areas in a cost-effective manner. The hyperspectral sensors are able to map seafloor morphology, seabed structure, depth of bottom surface and an estimate of sediment development. The considerable spectral portions are selected using an appropriate configuration of hyperspectral cameras to maximize the spectral resolution. Data acquired by hyperspectral camera are geo-referenced synchronously to an Attitude and Heading Reference Systems (AHRS) sensor. The data can be subjected to a first step on-board processing of the unmanned vehicle before be transferred through the Ground Control Station (GCS) to a Processing Exploitation Dissemination (PED) system. The recent introduction of Data Distribution Systems (DDS) capabilities in PED allow a cooperative distributed approach to modern decision making.

Two platforms are used in our project, a Remote Piloted Aircraft (RPAS) and an Unmanned Surface Vehicle (USV). The two platforms mutually interact to cover a surveyed area wider than the ones that could be covered by the single vehicles. The USV, especially designed to work in very shallow water, has a modular structure and an open hardware and software architecture allowing for an easy installation and integration of various sensors useful for seabed analysis. The very stable platform located on the top of the USV allows for taking-off and landing of the RPAS. By exploiting its higher power autonomy and load capability, the USV will be used as a mothership for the RPAS. In particular, during the missions the USV will be able to furnish recharging possibility for the RPAS and it will be able to function as a bridge for the communication between the RPAS and its control station.

The main advantage of the system is the remote acquisition of high-resolution bathymetric data from RPAS in areas where the possibility to have a systematic and traditional survey are few or none. These tools (USV carrying an RPAS with Hyperspectral camera) constitute an innovative and powerful system that gives to the Emergency Response Unit the right instruments to react quickly.

The developing of this support could be solve the classical conflict between resolution, needed to capture the fine scale variability and coverage, needed for the large environmental phenomena, with very high variability over a wide range of spatial and temporal scales as the coastal environment.