Science

Hydrothermal Exploration with the Autonomous Benthic Explorer


The paper describes a three-phase use of the Woods Hole Oceanographic Institution’s autonomous benthic explorer (ABE), to locate, map and photograph previously undiscovered fields of high-temperature submarine hydrothermal vents. Previously, hydrothermal exploration relied upon deep-tow instruments equipped with sensors that could locate sites of active ‘black smoker’ venting to within a few kilometres. Follow-on CTD tow-yos could then resolve the sites of sea floor venting to length scales of less than a kilometre but rarely to better than a few hundreds of metres. The new approach presented in the paper uses sensors to locate the centre of a dispersing non-buoyant hydrothermal plume 100–400 metres above the seabed; makes high-resolution maps of the sea floor beneath the plume centre whilst simultaneously detecting interception of any rising, buoyant hydrothermal plumes; and dives to the sea floor to take photographs in and around any new vent site to characterise its geological setting and reveal the nature of any chemosynthetic ecosystems it may host. By conducting all of the above under long-baseline navigation, precise sites of venting can be determined to within 5 metres. This approach can be used both to address important scientific issues in their own right and to ensure the much more efficient use of other deep-submergence assets such as human-occupied vehicles and remotely operated vehicles during follow-on studies.

http://www.sciencedirect.com/science/article/B6VGB-4R7J619-1/1/2bd3d39e9482e2c1cb6b84a3a40fb113

Rapid Environmental Assessment with Autonomous Underwater Vehicles

Examples from HUGIN Operations


The current generations of the HUGIN autonomous underwater vehicles (AUVs) have been used in a number of rapid environmental assessment (REA) missions over the past few years. This article discusses some of the main advantages and limitations of using AUVs in REA operations. The fact that AUVs usually employ a number of sensors simultaneously also gives rise to one of their limitations. The various sensors typically work best at different altitudes, speeds, etc. Thus, the operational mission parameters are always a trade-off between a number of considerations. The paper discusses some of these trade-offs. Four examples of operations with AUVs in REA operations focus on data from bathymetric and imaging sensors. These examples illustrate that today’s systems are able to contribute substantial military worth and should be used when applicable.

http://www.sciencedirect.com/science/article/B6VF5-4N2D2S6-3/1/3ee944a4f2dce4764639eba107439d69

Carbide-based Fuel System for Undersea Vehicles?


In underwater applications such as unmanned undersea vehicles, oxygen storage, maintaining neutral buoyancy of the vehicle and mass, and volume constraints often dictate system energy. A novel carbide-based fuel system (CFS) intended for use with a solid oxide fuel cell (SOFC) is under development that is capable of achieving energy metrics, as well as sequestering carbon dioxide. The paper describes a system configuration, discusses energy storage metrics and operational parameters, and gives a preliminary safety analysis. The results show that it is feasible that energy density needed for underwater applications may one day be achievable; however, the safety concerns of the CFS must be adequately addressed before this design is suitable for vehicular platforms.

http://www.sciencedirect.com/science/article/B6TH1-4PVPVR4-8/1/655f917b9ff9bbac4f89e93649809b7
Patchiness or spatial variability is ubiquitous in marine systems. With increasing anthropogenic impacts to coastal resources and coastal systems being disproportionately large contributors to ocean productivity, identifying the spatial scales of this patchiness, particularly in coastal waters, is of critical importance to understand coastal ecosystem dynamics. The work in this paper focuses on fine-scale structure in three coastal regions. Therefore, sub-kilometre scales of variability in biological and physical parameters measured by an autonomous underwater vehicle are identified.

http://www.sciencedirect.com/science/article/B6VBJ-4PGY4YB-1/1/bb50429b13d93dd8241792949a3ade5b

https://www.hydro-international.com/content/article/science-3