Autonomous Legged Underwater Vehicle (ALUV)

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LONG TERM GOAL

Develop a suite of innovative technologies that converge to provide a unique and effective means for systematic detection and classification of mines in the surf zone (SZ) and on the beach. The most promising technologies will be deployed on an Autonomous Underwater Vehicle (AUV) platform, which will provide a mobile, stable platform for operations in the required regions.

OBJECTIVE

Integrate and demonstrate candidate sensor performance, mobility and object marking/mapping capability in the surf zone environment. The work will involve developing sensors for obstacle or mine detection, discrimination, and classification. The developed sensors will be integrated into the Ariel Autonomous Legged Underwater Vehicle (ALUV), and the resulting platform/sensor combination will be demonstrated in a field test.

APPROACH

Sensor Evaluation

Review, evaluate, and analyze the capabilities of candidate close-range sensors for detecting and marking or mapping obstacle and mine types typically found in the SZ. This investigation will include estimation of performance based upon classification time, classification accuracy, probabilities of detection (Pd) and false alarm (Pfa), and the ability to discriminate between targets and non-targets for inclusion in computer simulations of area searches. This investigation shall include various sensor techniques, such as tactile, pulse induction, magnetic, acoustic, chemical, etc. Where possible, samples or prototypes of SZ targets and non-targets will be procured and tested to determine characteristics.

Report Documentation Page

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Target Localization

Conduct comparative analyses between accomplishing the reconnaissance mission either by marking targets or mapping the target field. This analysis will analyze the requirements for the ALUV vehicle command and control, required communications reporting capabilities, field coverage, delivery requirements, and target marking methods.

ALUV Demonstration

Demonstrate the integration and performance of a candidate sensor within the ALUV vehicle, and the mobility and marking/mapping capability of the system functioning in the SZ environment. The ALUV vehicle to be used for the demonstration will be the government furnished Ariel vehicle, shown in Figure 1, developed by the Defense Advanced Research Projects Agency (DARPA). The demonstration will be conducted at Coastal Systems Station, Panama City, Florida.

Figure 1. The Ariel ALUV

WORK COMPLETED

A magnetic material detector has been installed on one of the Ariel robot's feet for demonstration at Coastal Systems Station. However, the Ariel robot's condition has severely deteriorated since the DARPA demonstration and the Ariel robot is not currently in an operational condition. Substantial refurbishment and upgrades are necessary as pre-requisite for sensor integration and demonstration. The problem appears to be lack of bandwidth between Ariel's computer and the servo controllers that are responsible for locomotion. The locomotion-processing load was found to exceed the capacity of on-board computer resources. Alternatives to processor replacement have not been successful, so this necessitates the replacement of the on-board processor with a more powerful processor, which will have up to six months schedule impact.

RESULTS

Project will not be complete in September 1998, as originally planned. A demonstration of the improved vehicle is now planned for approximately March of 1999 at Coastal Systems Station.

IMPACT/APPLICATIONS

The current Ariel vehicle lacks the maturity and robustness as a non-expendable sensor, marking and mapping test platform. Upgrades are in process to improve the performance of the vehicle to make it more robust for the surf zone environment. Additional legged vehicle R&D is indicated.

TRANSITIONS

None this fiscal year.

RELATED PROJECTS

DARPA ALUV, Lemmings and NAVSEA (PMS-407) SBIR for Sea Dog investigate mine and obstacle detection of smaller targets within the surf zone by autonomous vehicles.

The Basic UXO Gathering System (BUGS) project at NAVEODTECHCTR is developing and testing vehicle technologies for gathering and picking up unexploded ordnance.

DARPA is examining technologies for autonomous vehicle operations in hazardous urban warfare environments.