

Reacquire Identify and Localize Swimmers

Rick Vosburgh
Nekton Research LLC
4625 Industry Lane
Durham, NC 27707

phone: 919-405-3993 fax: 919-405-3994 email: rvosburgh@iRobot.com

Contract: N00014-08-C-0020

<http://www.irobot.com/sp.cfm?pageid=393>

LONG TERM GOALS

The long term goal of this effort is development of a high speed UUV for intercept, localization and trailing of swimmers comprising a threat to ships in port. This vehicle is intended to close rapidly with a threat location to Reacquire, Identify, Localize Swimmers, with capabilities to track evading swimmers to support capture of threats.

OBJECTIVES

Technical Objectives in support of the long term goal include specification and design of an A-size (4.875" diameter) vehicle with integrated ultrasonic imaging and tethered RF buoy capable of supporting real time streaming of sonar images to a remote operator who can control the vehicle via the same RF link.

APPROACH

Our approach is to develop a swimmer defense UUV based on our other vehicles and on our notional CONOPS confirmed by sponsor. Development is based on a capabilities and requirements document aligned with the CONOPS. This document is then used as basis for a detailed work plan involving analysis, coordination with and providing of technical statements of work to outside suppliers of key hardware and software components, in support of internal mechanical design and fabrication efforts.

Vehicle hydrodynamic analysis and autopilot development is conducted by a subcontractor, with the autopilot to be integrated in the fabricated vehicle. Mechanical design is constrained by required center of buoyancy, center of gravity, fin placement, shape and performance, and shape guidance. As subsystems are assembled, they are bench tested and integrated for higher level system bench testing, followed thereafter by in water testing.

WORK COMPLETED

Work at Nekton is on schedule and under budget, with some work by subcontractors due before September 30, 2008.

At the kickoff in February 2008, we hosted a discussion with sponsor to confirm our notional CONOPS and performance specification of the vehicle, as was the schedule and locus for exit

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE 30 SEP 2008		2. REPORT TYPE Annual		3. DATES COVERED 00-00-2008 to 00-00-2008	
4. TITLE AND SUBTITLE Reacquire Identify And Localize Swimmers				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Nekton Research LLC,4625 Industry Lane,Durham,NC,27707				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES code 1 only					
14. ABSTRACT The long term goal of this effort is development of a high speed UUV for intercept, localization and trailing of swimmers comprising a threat to ships in port. This vehicle is intended to close rapidly with a threat location to Reacquire, Identify, Localize Swimmers, with capabilities to track evading swimmers to support capture of threats.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 3	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

demonstration at AUC Fest 09. Since kickoff, we have completed the capabilities and requirements document. We then produced a detailed work plan complete with milestones and personnel allocations. We then conducted a risk analysis and generated a risk areas document to further focus engineering effort.

As part of the engineering effort, we conducted an analysis of power budget for the vehicle, with propulsion, sonar imaging and wireless communications being key factors. Based on this analysis, we conducted a study of motors and batteries, and size selected components for these systems. Analysis of the processor requirements to support the autopilot and other vehicle software processes, we have identified a new processor capable of higher through put, having a floating point capability lacking in other candidates.

Initial requirements were provided to our imaging sonar provides, BlueView Technologies regarding frequencies, range capabilities and mechanisms of integration into the vehicle. In these discussions, we were provided estimates of maximum bandwidth required for streaming of uncompressed sonar images.

Based on estimated bandwidth requirements, we investigated COTS radios suitable for integration in a buoy to stream images and operator commands. Based on range and data rate capabilities, a WiFi radio from Silex was selected.

We then generated design concepts for the vehicle and the buoy as the basis for a Preliminary Design Review, which was conducted and a preliminary design was selected from the candidates as the basis for initiation of detailed design.

Initial hydrodynamic analysis by Vehicle Control Technologies is due for completion by September 30.

Prior to PDR, we specified MOOS compatible software modules for certain of the functions and adapted suitable others from our other UUV development efforts.

Following PDR, we generated an imaging requirements document that was provided to sonar device supplier, BlueView Technologies. As part of this process, we generated a detailed design for the sonar end cap to facilitate integration. We also updated the specifications document for the vehicle, buoy, tether and RF base station.

As part of vehicle specification we also conducted a weight and balance analysis of the vehicle before and after buoy release as the basis for analyzing stability and control of the vehicle in both states. We then conducted detailed design of the payload section of the vehicle and the battery portion of its payload. We have also partly completed detailed design of the buoy, tether, antenna and base station components of the system.

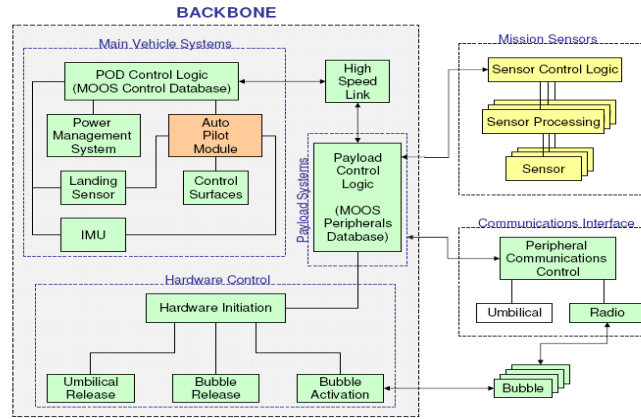
Critical design review is scheduled for September 30.

RESULTS

Since kickoff this past spring, the project has proceeded on schedule and budget.

Results include capabilities and requirements documents generated to support modular hardware and software designs and the operational capabilities confirmed with sponsor.

Detailed hardware design will follow Table 2 illustrates the software design implemented on Linux for our products including the dispenser



**Table 3. Block diagram of dispenser software architecture
Based on other devices developed for mine warfare**

The hardware to support this software will be based on a newly selected processor family with floating point capabilities. Internal testing is now underway with the leading candidate hardware.

IMPACT

The UUV being developed to rapidly Reacquire Identify and Localize Swimmers is a high speed device supporting requirements for track and trail of divers posing a threat to ships in port and port infrastructure. The high speed for rapid closing with a threat and small man portable size for ease of deployment from dock or small boat combined with the ability of the system to provide high resolution images of the threat to a remote operator in real time and to permit the operator to control RILS once it has closed with the threat location will provide the Navy with the ability to quickly engage potential threats while at the same time avoid inadvertent injury to marine mammals or non-hostile divers.