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DDR&E's J.M. "Raleigh" Durham Visits SSC Pacific

UrbEE project manager Estrellina Pacis (lower right) discusses recent user testing at Fort Benning, GA, with Raleigh Durham (far left), CAPT Kohlheim, and RADM Bachman (center).

On October 27th, 2009, RADM Michael Bachmann (COMSPAWAR) and CAPT Mark Kolheim (SSC-Pacific) hosted a VIP visit to the *Unmanned Systems Branch*, Code 7171, by J.M. "Raleigh" Durham of the Pentagon's *Director of Defense Research and Engineering (DDR&E)*. Following a high-level introductory overview by Bart Everett, selected branch projects related to vehicle autonomy and collaboration were presented by Hoa Nguyen. The principal focus of Mr. Durham's visit, however, was on live demonstrations of autonomous unmanned vehicles across the operational domains of air, land, and sea, with command and control provided by the *Multi-Robot Operator Control Unit (MOCU)* software.

The initial demo, using a Foster-Miller *Talon* and an iRobot *PackBot*, illustrated how *MOCU* can also serve as a common controller for thousands of teleoperated EOD robots currently deployed in theater. The *Urban Environment Exploration (UrbEE)* team next demonstrated *MOCU* controlling their

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UrbEE Team Participates in HRED Experiment at Fort Benning

The *Urban Environment Exploration (UrbEE)* team conducted an autonomous unmanned ground vehicle (UGV) experiment at the Molnar MOUT Site, Fort Benning, GA, September 14 – 24, 2009. Also participating were the Army Research Laboratory (ARL) Human and Research Engineering Directorate (HRED), ARL Computational and Information Sciences Directorate (CISD), Think-A-Move (TAM), Ltd., and thirty Officer Candidate School (OCS) cadets.

The purpose of the experiment was to investigate the effects of progressive levels of autonomy and speech control on robotic-reconnaissance task performance.

There were three stations: 1) *Route Reconnaissance Course*, operated by ARL: CISD; 2) *Building Reconnaissance Course*, operated by SSC Pacific; and, *Speech Control Intuitiveness Test*, operated by TAM.

The UrbEE team provided an iRobot *PackBot* equipped with the *Autonomous Capabilities Suite (ACS),* which supports three modes of control: tele-operated, semi-autonomous, and fully autonomous.

The *Building Reconnaissance* station consisted of three different one-story structures, similar in size but with different floor plans and

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Pictured, from left to right, Chris Blanco (Think-A-Move), Estrellina Pacis (SSC Pacific), Donald Fellars (SSC Pacific), David Baran (ARL, CISD), Gaurav Ahuja (SSC Pacific), Barry O'Brien (ARL: CISD), Greg Kogut (SSC Pacific), Jonathan Brown (Think-A-Move), and Stuart Young (ARL: CISD). Brandon Sights (SSC Pacific) not pictured.

DDR&E's Raleigh Durham Visits SSC Pacific (*continued*)

Autonomous Capabilities Suite (ACS), a modular open architecture for unmanned ground vehicles, running on a *PackBot Scout*. This demo showed the fully autonomous robot exploring and mapping the interior and exterior surroundings of a previously unknown building.

The *Autonomous UAV Mission System (AUMS)* team discussed their modular payload designed to forward deploy and autonomously refuel vertical-takeoff-and-landing (VTOL) unmanned air vehicles (UAVs). The *AUMS* system can be used standalone or mounted on a manned or unmanned ground vehicle. A specialized high-frame-rate video sensor funded by ONR-Global is being evaluated for augmenting the precision-landing phase in GPS-denied areas.

Other projects presented included: 1) the *Networked Remotely Operated Weapon System (NROWS)*, a standalone weapons platform that can be deployed by an unmanned ground vehicle or fixed in place to provide a remote-response capability for security or force-protection scenarios; 2) the *Unmanned Surface Vehicle (USV)*, a pair of 20- and 22-foot development platforms supporting navigation, obstacle avoidance, and path planning for autonomous surface craft; and 3) the *Mobile Detection Assessment Response System (MDARS)*, an autonomous robotic security vehicle developed by the US Army for tri-service use.

In conclusion, Captain Mike Carter discussed the SSC Pacific role in managing the *Robotic Systems Pool (RSP)*, created in 2002 as a joint venture between the *Defense Advanced Research Projects Agency (DARPA)* and what is now the *Joint Ground Robotics Enterprise*. Since then, the *RSP* has provided our warfighters and first-responder agencies with ready access to commercial and specialized robotic systems for training and indoctrination. In exchange for this "no-charge" loan, participants provide valuable feedback on the effectiveness of the *Pool* assets in realistic field settings. ♦

UrbEE Team Participates in HRED Experiment at Fort Benning (*continued*)

Test site at Ft. Benning, GA. Tests included Route Reconnaissance Course, Building Reconnaissance Course and Speech Control Intuitiveness Test.

contents, so the cadets were able to recon a different building with each level of autonomy. Interior rooms had tables, chairs, and other furnishings, including items of tactical significance (i.e., booby traps, IEDs, and weapon caches). The remote operators were located in a stationary position beyond line of sight of the robot. Each was briefed on the autonomous behaviors provided under ACS and had 20 minutes hands-on training to become familiar with SSC's *Multi-Robot Operator Control Unit* (*MOCU*).

The cadets were instructed to search for items of interest in each building, then return their robot to the starting point as quickly as possible. During each iteration, a data collector asked several questions concerning the operations order presented to the cadets before the exercise, which imposed an additional cognitive load. The number of correct answers and the time to respond were recorded.

The operators turned in their floorplan maps at the end of each iteration, suitably annotated with the location

Gaurav Ahuja explains to a participant how to properly navigate through the operating system during HRED testing.

Greg Kogut gives an overview of the ACS semi-autonomous behaviors before hands-on training began.

and identification of found items of interest, then filled out questionnaires and a NASA Task Load Index concerning the level of workload experienced. Demographic data was also taken concerning the physical characteristics and previous experience of each cadet, especially with regard to remote-controlled vehicles.

No major failures of the *ACS* and *MOCU* software were experienced during the ninety test runs (eighteen per day) conducted during the experiment. Speech control, usability, and level of automation were evaluated based on objective performance data, data-collector observations, and the operator questionnaires.

For further reports of the UrbEE team's progress or past demos and literature, please visit http://www.spawar.navy.mil/robots/ and navigate to "Publications."♦

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Kathryn M. Curd, Editor
robotics@spawar.navy.mil

Released by:
H.R. (Bart) Everett
Technical Director
for Robotics

www.spawar.navy.mil/robots/