SPAWAR Systems Center San Diego

ROBOTICS UPDATE

"Providing network-integrated robotic solutions for C4ISR applications."

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Learning Channel Films Robotic Warfare

Producers for the *Learning Channel* visited Space and Naval Warfare System Center's Adaptive Systems Branch on June 4th to film an upcoming documentary on "technology that will change the way we fight wars."

The filming captured the coordination of multiple assets, including SSC San Diego's Command Center of the Future (CCOF), MDARS Interior/Exterior, URBOT, and the Robotic Operations Command Center (ROCC), in a futuristic combat scenario.

Two URBOTs - lightweight man-portable tactical robots - staged an attack on Field House 36, which was being defended by MDARS Interior and Exterior platforms. The MDARS Interior security robot detected the URBOT intrusion and alerted the local guard force.

Cameras focus on MDARS-E battling URBOT with red colored ammunition

The MDARS Exterior robot was then deployed to disable the URBOT using its non-lethal weapons pod, a modified *Angel 2001* paintball gun mounted on a customized turret. The automatic air-powered rifle shoots 12-15 rounds of paint or pepper balls a second.

The ROCC coordinated control of the robotic resources with the CCOF, simulating a combat situation. The ROCC operator utilized the network-centric Multiple Resource Host Architecture (MRHA), developed by SPAWAR's Adaptive Systems Branch, to monitor and command the MDARS robots.

The URBOTs were controlled via a backpack OCU that provided digitized audio and full-motion video to the "enemy" soldiers over a single 802.11 wireless Ethernet (*BreezeNET Pro.11*) radio. Hardware audio/video compression is performed by the *IndigoVision VP400/VP500* CODECs.

The documentary will air on the *Learning Channel* in October.

Marsupial Platforms Expand Robotic Capabilities

MDARS-E with carrier for URBOT

SAIC Unmanned Harbor Security Vehicle

SSC San Diego Robotics announces its latest concept design for the MDARS Exterior platform: a marsupial carrier. Designed to transport the URBOT, the carrier allows MDARS-E to expand its force-protection and force-multiplication capabilities, and to enhance the ability to provide a tactical response.

This synergistic integration takes advantage of the inherent strengths of both platforms. MDARS-E is a rugged four-wheel hydrostatic-drive diesel-powered vehicle that can travel over long distances, transporting the URBOT closer to its destination. MDARS-E utilizes several sensor technologies, including active-laser, ultrasonic sonar, and stereo-vision sensors for collision avoidance.

The URBOT is a low-profile tracked robot that is controlled by an operator via an RF link. It is fully invertible, completely waterproof, and employs four video cameras. Its small size (can fit through a 24-inch manhole) and excellent maneuverability make it ideal for tunnel and sewer reconnaissance in the below-ground infrastructure associated with urban warfare. The onboard nickel-metal-hydride rechargeable batteries provide average mission durations of between 4 and 5 hours. The remote operator can communicate with the URBOT by relaying through the longer-range MDARS RF network, which uses the same integrated format for all-digital transmission of video, audio, and control data.

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SAIC Unmanned Harbor Security Vehicle

four-wheel hydrostatic-drive diesel-powered vehicle that 24-inch manhole) and excellent maneuverability make it

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Non-Lethal Weaponry Installed On MDARS Exterior

Taking just three weeks from concept formulation to initial testing, an *Angel 2001* paintball gun was completely integrated with the MDARS-E platform and the Multiple Host Resource Architecture (MRHA). Its maximum firing rate is 13 rounds-per-second, but with the time restrictions due to the paintball hopper it averages between 10-12 rounds per second. A camera is mounted directly above the barrel of the gun to allow the operator to accurately view the target. The operator uses a joystick at the command console to pan and tilt the camera, and to fire the weapon.

The paintball gun uses .68-caliber *RPS Marballizer* ammunition, and is supplied air from a 4500-psi accumulator. The 1440-cubic-inch accumulator can hold enough air to fire approximately 1500 rounds before refilling. The pan action for the gun turret is

Paintball gun enclosed in turret

implemented using a Dojen M03 reduction unit powered by a 24-volt DC motor producing a maximum of 500 in-lbs of torque. The tilt action is supplied by a 24-volt DC *Ultra Motion Smart Actuator*, model SA2.

The gun pod is controlled by an *ipEngine* (PowerPC) from Brightstar Engineering. The *ipEngine* is located inside the gun pod electronics box which is under the black shroud. The control software is based upon the Small Robot Technology architecture that is common to all D371 network-enabled resource devices (NERDs). The gun pod operates as an independent software agent that registers itself with the MRHA Operator Station. The Operator Station issues standard payload movement commands as well as payload arm and fire commands.

Potential future work includes automatic target detection/tracking; coordinated/cooperative targeting between multiple autonomous weapons pods; size reduction of the hardware; use of alternative rounds (i.e., pepper balls as used by the Border Patrol); and advanced detection sensors (radar, acoustic, seismic).

Marsupial Continued:

URBOT with *iSTAR* OAV

SSC-SD is currently investigating future expansions of this marsupial concept to include an amphibious URBOT delivery, employing an adaptation of SAIC's Unmanned Harbor Security Vehicle. In addition, efforts are also underway to perform a near-term feasibility demonstration of an integrated UAV/UGV concept, launching the 29-inch *iSTAR* UAV developed by Micro Craft from atop the MDARS-E vehicle. Follow-on plans call for integrating the smaller 9-inch model of *iSTAR* onto the URBOT.

Robotic Operations Command Center Goes Live

Robotics at SSC-SD received a big boost with the completion of the Robotic Operations Command Center (ROCC).

The ROCC is a tactical operations center for deploying and monitoring robotic systems in and around SSC San Diego's Seaside robotics facility.

It is used for both VIP demonstrations and for test and evaluation of advanced robotic technology development programs such as MDARS, MPRS, and the DARPA MARS/SDR projects.

The ROCC control room contains three wall-mounted Hitachi 37-inch plasma display panels; a three bay guard con-

ROCC Command Console and plasma display panels

ten stadium-style theater seats for visitors; a 5.1 channel Dolby surround sound audio system; adjustable overhead lighting; and a DirecTV satellite dish for monitoring news

The ROCC equipment room is located adjacent to the control room and contains a two-console KVM switch that enables operation of the system from either location.

The MRHA components are installed on six Pentium III CPUs with 256 MB RAM.

An *Extron DVS 150* video scaler converts RGB, S-video, and composite video signals to RGB-HV and SXGA video for viewing on the plasma monitors. The *Color Simplex Multiplexer* from ROBOT Corporation allows up to nine (digital or analog) video images to be displayed simultaneously on the center monitor.

Multimedia capabilities include DVD, CD-ROM, VHS,

For More Information

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tachi 37-inch plasma display panels; a three bay guard console with 19-inch monitors; lighting; and a DirecTV satellite dish for monitoring news and information.

Multimedia capabilities include DVD, CD-ROM, VHS, and computer MPEG.

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