SPAWAR Systems Center San Diego

ROBOTICS UPDATE

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

www.spawar.navy.mil/robots/

19 August 2002 / Vol. 2, No. 2

Newt Gingrich Visits Robotics Group

Former Speaker of the House Newt Gingrich visited SPAWAR Systems Center San Diego on Friday, July 19th, on a fact-finding mission for the Secretary of Defense. His goal was to investigate promising technologies that could potentially enable transformations for gaining significant military operational advantage.

The Robotic Systems Branch participated by providing a force-on-force warfighting demonstration involving the MDARS Interior and Exterior robots in a defensive role, fending off an attack by the Man Portable Robotic System (MPRS) Urban Robots (URBOTs). The Allied Aerospace 9-inch and 29-inch iSTAR ducted-fan Unmanned Air Vehicles, which can be carried as marsupials, were also on display.

Mr. Gingrich and Rachel Tenwolde, an Office of Naval Research Intern

Mr. Gingrich was particularly interested in the use of robots for mine clearing, force protection, and homeland security applications.

Examining the chemical sensor mission module on the URBOT

Bart Everett presents the Branch's 20-year history to Mr. Gingrich

Among those accompanying Mr. Gingrich were Captain Timothy Flynn, the new Commanding Officer of SSC San Diego, and Dr. Bob Kolb, civilian director.

Free-Flight Launch of iSTAR from MDARS-E

Allied Aerospace and SSC San Diego performed the first free-flight launch of an Unmanned Air Vehicle (UAV) from an autonomous Unmanned

debugging of flight control software. A quarter-mile-wide free-flight zone extends north from this tethered-flight area approximately nine-tenths of a mile along the

landing approach. Additional redundancy will be provided by a passive onboard vision system which tracks a cooperative target built into the launch/recovery

Ground Vehicle (UGV) on July 27, successfully concluding Phase I of this three-phase UAV/UGV integration effort.

iSTAR UAV launches from MDARS-E

In support of this project, a UAV flight-test capability has been added to the existing SSC San Diego ground robotics test area on Woodward Road. The new facility is equipped with two 80-foot utility poles supporting an overhead safety tether to ensure no damage to equipment or personnel during initial testing/

Pacific coastline, providing over-flight test conditions that encompass a rich variety of terrain features in the littoral zone.

Phase I commenced in February 2002. An initial feasibility test, conducted on March 14 at the Hotville Regional Airport, demonstrated a tethered take off of the 29-inch iSTAR ducted-fan UAV from a prototype fiberglass launch fixture attached to the MDARS-E platform. Limitations in this early three-spoke design created stability problems for the vertical-takeoff-and-landing air vehicle in the presence of strong crosswind components, necessitating an improved six-spoke fixture with a solenoid-actuated release mechanism. This approach allows the UAV to run its engine up to full power before launch, verify proper RPM and thrust, and then be physically released to accelerate more rapidly out of the transition

iSTAR UAV in free flight over SSC San Diego facilities

zone where crosswind effects are most pronounced. The modular launch fixture attaches to the standardized MDARS-E payload mount and is compatible with the existing connections for power and communications.

Phase II of this effort, which will address the automated recovery of the iSTAR UAV by the MDARS-E robot, is now underway. A novel (small and lightweight) *epoch-by-epoch* GPS system developed for SSC San Diego by Geodetics, Inc., will allow the UGV to serve as a DGPS master station for the flying vehicle, minimizing relative positioning errors between the two during the closed-loop

fixture, yielding high-bandwidth translation, orientation, and altitude information.

The final phase of the UAV/UGV effort will incorporate automated launch, recovery, refueling, and re-launch functionalities into a fully integrated system. The two-stroke gasoline engine will be replaced by a rotary diesel engine, allowing fuel to be supplied directly from the existing MDARS-E fuel tank.

Target recipients of the modular UAV launch/recovery application package currently include the Defense Advanced Research Projects Agency (DARPA) PreceptOr Program headed by Dr. Scott Fish, and the Cooperative Unmanned Ground Attack Robots (COUGAR) Program headed by Robert Wade, Army AMRDEC.

Unmanned Surface Vehicle in Fleet Battle Experiment

SSC San Diego assisted SAIC personnel in preparing the OWL Mk III Unmanned Surface Vehicle (USV) to participate in Fleet Battle Experiment – Juliet, a military exercise designed to evaluate new technologies for mine-counter measure operations.

Sidescan (Edgetech MP-X, 270

OWL Mk III USV off the coast of California

cise to facilitate transportation of equipment and simplify mobilization on the host vessel. The wireless link between the host and the USV was implemented using COTS 2.4-gHz 11-Mbps radios. The high-bandwidth RF link supported full-quality sonar data along with compressed video images from the driving camera. Four high-resolution

SAIC and SSC SD personnel used RHIB for test and integration

kHz) and acoustic Doppler current profiling capabilities (RDI Workhorse Navigator, 600 kHz) were added to the 10-foot craft to provide real-time information to operators stationed on the host ship, the HSV Joint Venture (HSV-1). Additional sensors included a high-resolution low-light camera, and an Imaging Sensors and Systems model 300LS cooled thermal imager for reconnaissance operations. The optical sensors were interfaced through Intergraph Vipers video analysis system, which provided the ability to post process poor quality video into useful information.

In the test and integration phase, command and control was accomplished using laptop computers operating in a rigid hull inflatable boat (RHIB), which also served as the chase vessel for safety purposes. A command and control van was constructed for the exer- flat-panel displays and two dual-processor Pentium III computers allowed operators to easily monitor all functions and status without clutter or degradation of system performance.

During the exercise, held July 22-28, the OWL was tasked with collecting data in two separate geographical areas off Camp Pendleton, CA. Raw sonar data was time tagged, logged in the sonar bottle and merged with the USV position on board the host vessel, where it was also logged. Data displays for the sonar records were located in the USV control van and Combat Information Center. The system successfully provided real-time sonar data to analysts who categorized the content, and then submitted "mine-like snippets" to the Military Engineering Data Asset Locator System (MEDALS) operators for review.

Small Mobile Robot Pool to Increase End User Interaction

SSC San Diego, under the direction of the Joint Robotics Program and in collaboration with DARPA, is populating a pool of Small Mobile Robots (SMR) to be loaned to various governmental organizations at the Federal, State, and Local levels for operational testing and evaluation.

Once in the hands of the potential users, the SMR Pool assets will support field experiments (i.e. Concept Exploration Programs, Limited Objective Experiments) with new tactics and methods of operation. This hands-on experience should dramatically improve the user's understanding of the capabilities and limitations of the current technology, facilitate better articulation of their future requirements, and expedite the process manufacturers of small mobile robotic systems.

Currently there are four DARPA Tactical Mobile Robot (TMR) Program PackBots, four SSC San Diego URBOTs, and two Inuktun Variable Geometry Tracked Vehicles (VGTVs) in the pool. Additional platforms now on order include Inuktun Mini Mobile Disrupter Vehicles (MiniMDV), Micro Mobile Disrupter Vehicles (MicroMDV), VGTVs, Foster-Miller TALONS, iRobot PackBots, and Utah State University Omnidirectional Sensing System (ODIS) platforms. Additional orders will be placed in FY-03 based on user feedback. For more information

TALON by Foster-Miller

On the database homepage, click on the Robot Pool tab.

Four PackBots, two URBOTs, and two Inuktun VGTVs from the pool are already in the hands of military end users in Afghanistan, and the results have been very positive. Soldiers from the 82nd Airborne Division out of Fort Bragg have used the PackBots to roam caves and tunnels to ensure the areas are safe for troops to en- ing additional small mobile robots with new and differing capabilities for the pool so potential users will have a broad choice of equipment with which to experiment. Interested users who would like to borrow one of these SMR assets for periods of up to six months are invited to contact Dr. Mike Blackburn, (619) 553-1904, mike@spawar.navy.mil, or Mr. Aaron Burmeister, (619) 553-5576, burmeist@spawar.navy.mil, and to explore the SMR Technology Database at http://www.spawar.navy.mil/robots/.

of incorporating small mobile robots into their ongoing operations.

During the course of these experiments, SSC San Diego will collect feedback from the users, and report the results of these experiences to the Program Managers of various robot development programs, and to the

MiniMDV by Inuktun

on the platforms available go to the SSC San Diego robotics home page, http://www.spawar.navy.mil/robots/, and select the Mobile Robotic Technology Database link.

ter. The VGTVs and URBOTs are currently employed by Navy Explosive Ordnance Disposal Mobile Unit 3 for minefield assessment and clearing. The users have also suggested new ways to utilize the platforms for additional functions that will further increase their tactical value.

SSC San Diego is actively seek-

iRobot's PackBot with MDARS-E

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Approved for public release; distribution is unlimited. SD 352 August 2002