SPAWAR Systems Center San Diego

ROBOTICS UPDATE

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

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Allied Aerospace's UAV Launched From MDARS-E Platform

On Thursday, March 14, engineers from SSC San Diego and Allied Aerospace (formerly Micro Craft, Inc.) conducted the first known launch of a Vertical Take Off and Landing (VTOL) Unmanned Air Vehicle (UAV) from an Unmanned Ground Vehicle (UGV), at the Holtville regional airport just east of El Centro, California. The launch involved Allied Aerospace's 29-inch Lift Augmented Ducted Fan (LADF) *iSTAR* UAV and SSC San Diego's Mobile Detection Assessment Response System Exterior (MDARS-E) UGV platform.

The historic launch came at the conclusion of an end-of-project demonstration that Allied Aerospace conducted for DARPA under the Future Combat Systems (FCS) Organic Air Vehicle

Launch of *iSTAR* from MDARS-E

(OAV) Phase I effort. The FCS OAV program provides FCS direct and indirect weapons system targeting under all operating conditions at the small unit level. The week-long demonstration to DARPA included several fully autonomous vertical takeoffs and landings, as well as an autonomous high-speed flight.

In preparation for the UAV launch, the MDARS-E platform was augmented with the addition of a prototype fiberglass launch fixture developed by SSC San Diego engineers, designed to accommodate the same bolt pattern used to secure the Intrusion Detection System and/or the Non-Lethal Weapon payload modules. The MDARS-E platform was controlled remotely from a laptop using the Multiple Resource Host Architecture (MRHA) software developed initially by SSC San Diego for the Product Manager, Physical Security Equipment, at Ft. Belvoir, VA.

Strong winds gusting to 20 knots at the Holtville airstrip necessitated the use of a safety tether system for this preliminary test, but subsequent fully autonomous free flight launches from the MDARS-E platform are planned at SSC San Diego using a modified launch fixture and procedures that should effectively eliminate crosswind constraints.

SSC San Diego is forming a CRADA with Allied Aerospace to jointly pursue future UGV/UAV integration. Future plans call for a similar integration between Allied Aerospace's smaller 9-inch *iSTAR* and SSC San Diego's URBOT.

URBOT with 9-inch *iSTAR*

Robots Sent to Assist EOD Efforts For Operation Enduring Freedom

Four robots, two Inuktun Micro Variable Geometry Tracked Vehicles (Micro VGTV) and two SSC San Diego Urban Robots (URBOT), were deployed with the Explosive Ordnance Disposal (EOD) Mobile Unit 3 based out of North Island Naval Air Station in San Diego on April 1st, 2002, in support of Operation Enduring Freedom. These robots were part of a robotics pool funded by the Joint Robotics Program and managed by SSC San Diego's Robotics group.

The Micro VGTV is a remotely powered and controlled video inspection robot that can negotiate obstacles and change geometry while continuing to provide images to the operator. The operator receives the images via

LTJG Kevin Childre loading the Micro VGTV for deployment

a 30m tether which also supplies power to the robot. The robot can travel at speeds of 4.5 meters per minute and its camera, available in color or black and white, has a tilt range of +/- 90 degrees. The robot weighs 8.5 pounds including the tether. It was used during the rescue efforts in New York City following 9/11 and it is currently used for remote inspection by several organizations.

The URBOT is a lightweight, man-portable mobile robot designed for operation in urban environments (indoor, outdoor and underground). It is based on the Foster-Miller Tactical Adjustable Robot and is outfitted with upgraded electronics, a fully integrated digital communications link for video, bi-directional audio, and command data, four cameras with dual halogen headlights, and a wearable Operator Control Unit.

The URBOT is fully invertible, with an attitude sensor automatically determining which video camera to use if the robot flips over. Transparent to the operator, onboard software also inverts the

Micro VGTV: Multiple exposures show varying heights

sense of incoming drive and steering commands to preserve a normal mobility response. The project is funded by the Department of Defense Joint Robotics Program.

The robots will be used by a Navy EOD unit for remote inspection of mines and explosives overseas.

operator receives the images via New York City following 9/11 board software also inverts the sives overseas.

Code 2371 Reaches Out to Young Scientists and Engineers

Government agencies have a responsibility to invest in the education of our youth in order to foster interest in civil service, and to build the skills necessary to operate competitively – as government employees – in future global markets. Sparking the interests of today's youth in science and engineering, with the hopes of building future careers in robotics, is the goal of SSC San Diego Code 2731's outreach program.

Code 2371 supports Center outreach activities through hands-on robotics demonstrations, as well as a number of community programs aimed at educating young children, teenagers, and adults. The robotics group currently supports three on-going outreach programs within the San Diego community.

For two years, Code 2371 has taught robotics at a local elementary school as part of a science enrichment program. The curriculum is based upon concepts developed by FIRST LEGO League (FLL), which is a partnership between FIRST (For Inspiration and Recognition of Science and Technology) and LEGO. FIRST is a national non-profit organization whose goal is that of exposing children of all ages to science and technology. The curriculum uses the LEGO Mindstorms Robotics Invention System to teach robotics for solving real-world problems. FLL holds yearly competitions that challenge teams of students, ages 9-14, to perform in local and state robotics contests. For the last three years, Code 2371 personnel have volunteered as judges, inspectors, and referees at the state-wide LEGOLAND California FLL competition.

Last year, Robin Laird coached a team of fifth grade students at Benchley/Weinberger Elementary School who participated in the LEGOLAND competition – the students took 12th place out of 32 teams. Joan Baker, Code 2371, volunteered as a robot inspector for the competition. The elementary school robotics program is in its second year with classes starting each May and continuing through summer.

As a continuation of the FIRST LEGO League, the FIRST Robotics League is designed to encourage high school students to apply science and engineering skills to develop complicated robots to perform in regional and national competitions. This year, Aaron Burmeister and Nghia Tran, Code 2371, volunteered to mentor students at the UCSD PREUSS high school in the development of a robot that recently debuted in the FIRST Robotics competition held in Los Angeles. Both Mr. Burmeister and Mr. Tran volunteered their time to assist the students with the design of the robot, and the integration of the final system. The employees also traveled with the high school team to the competition in Los Angeles.

SSC San Diego engineer Nghia Tran works with Preuss School teacher and students

As a result of contacts made during Code 2371's participation in the 2001 San Diego Science Alliance Technology Fair held at Del Mar, CA, a new program was started last year at SSC San Diego that allows students from High Tech High School to work as interns in the robotics group. The students (four juniors) work 8 hours each week during school on a variety of robotics research and development tasks. Code 2371 employees Michael Bruch, Narek Manouk, Kathy Mullens, and Mr. Laird along with Bart Everett (Code 237) act as mentors in the program.

The High Tech High students, Justin Appel, Brandon Thompson, Stephen Schultze, and Brian Barlow, recently completed a preliminary design review for the development of a small-scale, clandestine surveillance robot. The students were teamed in pairs and required to formulate a novel robot design, and then formally present their design to Code 2371 personnel. The intern program is the result of a Memorandum Of Agreement between SSC San Diego and High Tech High School (led by Career Development Counselor Rebecca Haddock and faculty member Ben Daley). Code 2731 intends to continue the program indefinitely. Two of the high school interns have applied to work as summer student aides at SSC San Diego.

Employees have also been involved in other community outreach events. Mr. Laird and Mr. Everett participated in Science Fest 2001 at the Elementary Institute of Science in San Diego. They demonstrated the URBOT and ROBART III to hundreds of students in July during the day long event. Ms. Mullens and Mr. Manouk visited Guajome Park Academy and gave a presentation and demonstration in March 2001. Personnel from Code 2371 hosted San Diego area students from the Tribal Digital Youth Academy in the summer of 2001 for a tour of the facilities and a demonstration of the robots. Mr. Burmeister and Mr. Manouk represented SSC San Diego at the 2002 University of California-San Diego engineering fair.

Fifth grade students from Benchley/Weinberger Elementary School

SSC San Diego Code 2371
Robotic Systems Branch
Kathy Mullens

53406 Woodward Road
San Diego, CA 92152-7383
619.553.3666 (phone)

kmullens@spawar.navy.mil
www.spawar.navy.mil/robots/

Fifth grade students from Benchley/Weinberger Elementary School

selor Rebecca Haddock and faculty member Ben Daley). Code

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