Robots UAV and UGV Cooperation
(A 50% solution now!)

Stephen Wilkerson Ph.D. P.E. Raymond VonWhalde, Harris Edge, James Spangler Weapons Technology Analysis Branch (A), and LTC Robert Hansen Ph.D., P.E. West Point

The Army Research Laboratory
Aberdeen Proving Grounds
Maryland 21005-5066

ARL Sponsor: Weapons Technology and Analysis Branch

ABSTRACT:

Supply convoys have become easy prey for terrorists operating in rural Iraqi countryside. Terrorists can wire unexploded munitions alongside of roadways and then explode these munitions as convoy vehicles pass by. The munitions can easily be disguised as a pile of rocks or other debris typically found along remote stretches of roadways in the Iraqi backcountry. They can be wired to a remote site and then an observer can detonated them at the appropriate time. Furthermore, Iraqi combatants can hide behind berm or other small obstacles just prior to a vehicle arriving at an area and fire a Remote Guided Projectile (RPG) at a vehicle. In the absence of air cover it is relatively easy for enemy factions to carry out these type of sniper attacks with relative impunity.

Unmanned Air Vehicles (UAV) like Global Hawk or Predator give excellent overview surveillance of an area but cannot always be in areas where small convoys are traveling prior to the convoy arriving at a known problem area. What is required is "eyes-on" for the entire route and immediate vicinity to ensure that unfriendly Iraqi radicals don't slip in to area to carry out quick hit and run tactics just prior to the convoy's arrival.

Smaller unmanned vehicles like Dragon Eye offer a quick look and can be hand launched in front of a convoy to see if any danger exists ahead. They are small enough that being detected is unlikely and being shot down even more unlikely. Their cameras provide a birds eye view of the surrounding area and can easily help U.S. Soldiers detect movement on the ground. Unfortunately, these craft typically have very limited ranges (approximately 1-2 hour flying time) and are quite expensive.

An alternative might be to use small autonomous craft that can be preprogrammed to follow GPS waypoints and continuously stream back GPS laced video images. Moreover, the mere presence of these craft might act as a deterrent to the persistent attacks currently being experienced in the Iraqi countryside. Recently, a group from Maryland demonstrated that a small inexpensive radio control craft could be piloted across the Atlantic Ocean and recovered safely. In this case a small, 11 pound, craft was flown by computer using GPS waypoints some 1950 miles for over 39 hours using less then 1 gallon of fuel. The craft was hand launched and then on the other side of the Ocean was landed using standard radio control hardware. A soldier can learn how to pilot a craft like this to a landing in less then a week. The Weapons Technology and Analysis Branch has demonstrated GPS laced video images which are quite small and energy efficient. What's more, GPS driven auto pilot functions will be incorporated into these craft in the next several weeks, as they are currently being tested on ground robots. It is possible using simple technology to place a number of air assets over a trouble area providing early warning to U.S. soldiers. Furthermore, if these craft are propelled by gas or alcohol engines the noise could be an added benefit, as it will provide a constant reminder that someone is looking from above. The noise could also be mitigated if so desired. Since these craft are small and inexpensive a number of them could be employed to patrol an area over an extended period of time providing constant intelligence of nearby ground activities. As was demonstrated in the transatlantic flight a craft of this type can potentially remain aloft for numerous hours and cover a large distance or remain in an area for an extended period of time.

Finally, smaller sensors and Unmanned Ground Vehicles (UGV) robots can be dropped from such craft to set up sentry posts on the ground at specified locations. This talk will discuss an engineering approach to the problem and the progress that has already been made towards a solution. The focus will be on miniaturization of technology for use now.

KEY WORDS: Unmanned Air Vehicles (UAV), Unmanned Ground Vehicles (UGV), Autonomous Robots, Robot Miniatures,

CONTACT: Stephen Wilkerson, ARL MD 21005-5066 Tel: (410) 278-3966 email: swilker@arl.army.mil

Harris Edge, ARL MD 21005-5066 Tel: (410) 278-4317 email: edge@arl.army.mil

Jim Spangler, ARL MD 21005-5066 Tel: (410) 278-6677 email: spangler@arl.army.mil

Raymond VonWhalde, ARL MD 21005-5066 Tel: (410) 278-9738 email: vonwahld@arl.army.mil

LTC Robert Hansen, USMA, West Point, NY 10996
Tel: (845) 938-2816 email: robert.hansen@us.army.mil