

## **Technology Transfer to Army Fielded Combat Robots**

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### **Abstract**

The U.S. Army Research Laboratory (ARL) develops technology for future and more capable unmanned systems. These improvements are enabled through advancements in intelligent control, machine perception, human-machine interaction, mechanics, and propulsion. This interdisciplinary research crosses the boundaries of land, sea, and air, and addresses a wide variety of needs for military unmanned systems. These range in size from large Future Combat Systems vehicles to micro-scale soldier-carried robotic platforms. The Army, industry, and academia combine resources to upgrade fielded combat robots under the ARL-managed Robotics Collaborative Technology Alliance. The use of robots on the battlefield is among the most exciting advancements of technology in the DoD. The authors provided support to the ARL Human Research and Engineering Directorate (HRED) robotics team by transferring technology that originates in university research. The effort inserted machine vision into robots used in urban combat. This technology transition benefits from the very same codes being concurrently exploited in Windows-based robots and HPCMP HPC environments for the benefit of multiple applications. This project was carried out in two months, which compares well to the Army's normal expectation of eight years to bring new technology to the battlefield.

### **Introduction**

A process was established to examine results from university, contractor, and government researchers. Results that appear promising are built into stand-alone libraries for integration with application-specific drivers. In this project, we are working with Matlab, C/C++, and OpenCV. However, there is the potential for the integration of other libraries and languages.

The use of all collected material is used as background to satisfied mission requirements. Taken together, all components drive a technology transition process that significantly reduces time to insertion. In this case, only two months were required to insert university research into a fielded combat robot. That length of time was due to the considerably learning that was necessary. For the robot in question, only two weeks would now be needed for upgrades and perhaps one month for a new insertion. This compares well with the Army's expected eight years to bring new technology to fielded systems.

### **Application to Combat Robots**

Two robots were involved, the Pioneer DX laboratory robot and a combat-deployable PackBot produced by iRobot. This Army project provides continuous upgrades in combat capability and serves to lessen the risk to personnel in highly dangerous situations. Besides DoD applications, the PackBot is used for plant security, search and rescue, as well as chemical and nuclear accident recovery.

### **Significance to ARL HRED Mission**

The following benefits directly accrued to the target ARL HRED project:

- Transitioning Linux-based image processing capabilities to Windows-based combat robots.
- Minimizing barriers, costs, risks, and timelines to affect such transitions.
- Enabling transition of Windows-based real-time combat capability to Linux-based post-collect processing on cluster platforms, and visa-versa.
- Ready integration of research results to meet deployment requirements and to overcome emerging threats.
- Merging of disparate computer languages and programs to create new capability in response to evolving requirements and missions.

### **Significance to DoD Mission**

Unmanned (autonomous and non-autonomous) robotic systems are highly desired by combatant commanders (COCOMs) for the many roles these systems can fulfill. Tasks such as mine detection; signals intelligence; precision target designation, chemical, biological, radiological, nuclear, explosive (CBRNE) reconnaissance; and communications and data relay rank high among the COCOMs' interests. These unmanned capabilities help reduce complexity and time lag in the sensor component of the sensor-to-shooter chain for prosecuting actionable intelligence. Unmanned systems are changing the conduct of military operations in the Global War on Terrorism by providing unrelenting pursuit combined with the elimination of threats to friendly forces.