Control Technology for
Dexterous Multi-Arm Remote Manipulation

The DARPA Phoenix program envisions robotic spacecraft docking with retired, non-working satellites and performing mechanical "surgery" to remove and reuse components that were not designed to be removed on-orbit. The need to remotely grip, cut and modify these components will push the state of the art in telerobotic mobile manipulation. The complexity of the tasks involved will require the use of highly dexterous, high degree of freedom manipulators. In order to take full advantage of such manipulators it will be necessary to develop novel approaches to simplify the control of such highly dexterous manipulators.

Intelligent Automation's Multi-Arm Unmanned Ground Vehicle (MA-UGV) technology directly addresses this need by giving operators the ability to perform complex remote manipulation tasks with relative ease. The current MA-UGV testbed has three arms, three cameras and 29 degrees of freedom. Integrated video feeds from cameras on the end of each arm enhance situational awareness, primarily depth perception. The ability to command arm movement relative to various frames of reference, including any camera view, makes the robot easy to control. Autonomous behaviors reduce task dimensionality and enable an operator to focus on mission-specific degrees of freedom.

Demonstrated performance includes dual-arm backpack inspection, tool handling, shovel manipulation, door breaching, knot tying and IED defeat. Operational benefits of MA-UGV control system and operator interface technology include increased manipulation capability, shorter mission times and reduced operator workload.

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