Multi-robot Planetary Outposts (*CAMPOUT*), some supporting simulations, and physical experimentation to date with two rovers carrying a model payload over natural terrain.

**Issues in Robot Work Crew Research**

We are investigating previously unexplored and important problems in multi-robot coordination to do cooperative work in the moving and handling of objects on sloped and rocky planetary terrain. This research is of relevance to a wide variety of surface missions that require moving of either human made or natural objects on planetary surfaces. These mission operations include deployment of solar panels and other large infrastructures; movement of rocks, containers and other small objects; deployment of multiple sensor arrays for measurement and observation; anchoring of deployed structures; and clearing of terrain. The robot work crews could operate in a purely robotic mode, or they could be assist astronauts conducting extensive extra-vehicular operations.

This research is of interest because coordinated movement and mechanical force application has received little attention in robot team research, although a body of research is beginning to emerge. In addition, complexities due to terrain slopes and roughness add a variability that goes beyond currently solved problems in a field that is in its relative infancy. Prior and current research has focused mostly on group movement, along with its associated issues of communication, control, and navigation. Research has focused on three main types of activities: foraging, formation marching, and object (e.g. box) pushing. Foraging is the collective search and retrieval of a set of objects distributed over an area. The research focuses on how to get a group of robots to behave efficiently. Though retrieval is often part of the task, little effort has been made to describe the local actions to do the actual transport. Formation marching requires a group of robots to move from one point to another, while maintaining a constant geometric pattern and avoiding obstacles. Finally, box pushing requires at least two robots to work together to push an object from one point to another. As valuable as this early research is, it addresses mostly task planning and communication requirements for robot teams that are not physically linked. Much research remains to be done in mechanically connected multi-robot systems that are collectively conducting a complex "work" operation. This paper reports on our current activities and results in this increasingly important research domain.