NASA SBIR 2008 Phase I Solicitation

X1.01 Automation for Vehicle and Habitat Operations

Lead Center: ARC

Participating Center(s): JPL

Automation will be instrumental for decreasing workload, reducing dependence on Earth-based support staff, enhancing response time, and releasing crew and operators from routine tasks to focus on those requiring human judgment, leading to increased efficiency and reduced mission risk. To enable the application of intelligent automation and autonomy techniques, the technologies need to address two significant challenges: adaptability and software validation. Reusable automation software must be adaptable to new applications without undue difficulty, and easily adjusted as the application operations change. The software and the adaptation to a given application must also be trusted before it can be accepted. Proposals are solicited in the areas of:

Automation Support Tools

Support tools are needed to facilitate the authoring and validation of plans and execution scripts. Tools that are not tied specifically to one executive would provide NASA the most flexibility in applying such tools across projects. Examples of needed capabilities include:

- Graphical tool for monitoring and debugging plan execution;
- Graphical tool for creating and editing execution scripts;
- Tools for authoring and validating execution plans;
- User friendly abstraction of low-level execution languages by adding syntactic enhancements.

Decision Support Systems

Decision support systems amplify the efficiency of operators by providing the information they need when and where they need it. Decision support tools are needed that:

- Command and supervise complex tasks while projecting the outcome of actions and identify potential problems;
- Understand system state, including visualization and summarization;
- Allow the system to interact with a user when generating the plan and allow evaluation of alternate courses of action;
- Integrate a planning and scheduling system as part of an on-board, closed loop controller;
- Scale up existing techniques to larger problem applications.

Trustable Systems

Systems that support or interact with crew require a very high level of reliability. Tools are needed that improve the reliability and trustworthiness of autonomous systems. These include:

- Ability to predict what the system will do;
- Guarantees of behavioral properties;
- Other properties that increase the operator's trust;
- Verifiability (e.g., restricted executive languages that facilitate model-based verification).