



## NASA STTR 2004 Phase I Solicitation

### T1.01 Information Technologies for System Health Management, Autonomy and Scientific Exploration

Lead Center: ARC

Information technology is a key element in the successful achievement of NASA's strategic goals. Modern tools and techniques have the capability to redefine many design and operational processes, as well as enable grand exploration and science investigations. This subtopic seeks innovative solutions to the following information technology challenges:

- Onboard methods that monitor system health and then automatically reconfigure to respond to failures and sustain progress toward high-level goals. Special emphasis will be on computational techniques for coordinating multi-agent systems in the presence of anomalies or threats.
- Onboard, real-time health management systems that perform quickly enough to monitor a flight control system (including spacecraft and fixed or rotary wing aircraft) in a highly dynamic environment, and respond to anomalies with suggested recovery or mitigation actions.
- Integrated software capabilities that allow automated science platforms, such as rovers, to respond to high-level goals. This could include perception of camera and other sensor data, position determination and path planning, science planning, and automated analysis of resulting science data.
- Data fusion, data mining, and automated reasoning technologies that can improve risk assessments, increase identification of system degradation, and enhance scientific understanding.
- Techniques for interconnecting and understanding large heterogeneous or multidimensional data sets or data with complex spatial and/or temporal dynamics.
- Computational and human/computer interface methodologies for inferring causation from associations and background knowledge for scientific, engineering, control, and performance analyses.
- Software generation tools that capture designer intent and performance expectations and that embed extra knowledge into the generated code for use by automated software analysis tools doing validation and verification, system optimization, and performance envelope exception handling.
- Tools and techniques for program synthesis and program verification of high-assurance software systems.
- Innovative communication, command, and control concepts for autonomous systems that require interaction with humans to achieve complex operations.

