# NASA SBIR 2008 Phase I Solicitation

## X1.02 Reliable Software for Exploration Systems

**Lead Center: ARC**

**Participating Center(s): JPL, JSC, LaRC**

The objective of this subtopic is to develop software engineering technologies that enable engineers to cost-effectively develop and maintain NASA mission-critical software systems. Particular emphasis will be on software engineering technologies applicable to the high levels of reliability needed for human-rated space vehicles. A key requirement is that proposals address the usability of software engineering technologies by NASA engineers, and not only specialists in the technology.

Many of the capabilities needed for successful human exploration of space will rely on software. In addition to traditional capabilities, such as GNC (guidance, navigation, and control) or C&DH (command and data handling), new capabilities are under development: integrated vehicle health management, autonomous vehicle-centered operations, automated mission operations, and, further out, mixed human-robotic teams to accomplish mission objectives. It will be challenging, but critical to NASA's exploration objectives to ensure that these capabilities are reliable and can be developed and maintained affordably. Mission phases that can be addressed include not only the software life-cycle (requirement engineering through verification and validation) but also upstream activities (e.g., mission planning that incorporates trade-space for software-based capabilities) and post-deployment (e.g., new approaches for computing fault tolerance, rapid reconfiguration, and certification of mission-critical software systems).

Software engineering tools and methods that address reliability for exploration missions are sought, including:

- Automated software generation methods from engineering models that ensure integrity; for example, methods ensuring semantic equivalence between UML models and generated code, generated code optimizations that preserve semantics, and tools that provide navigable two-way traceability from models to code.
- Methods for ensuring safe modification and updates to existing code.
- Scalable verification technologies for complex mission software.
- Automated testing technology that ensures coverage targeted both at the system level and software level.
- Technology for calibrating software-based simulators and testbeds against high-fidelity hardware-in-the-loop testbeds in order to achieve dependable test coverage.
- Cost-effective architectures and methods for software fault tolerance for real-time mission-critical applications.

This subtopic also collaborates with the Small Spacecraft Build effort highlighted in Topic S4 (Low-Cost Small Spacecraft and Technologies). Respondents are encouraged to consider a possible flight opportunity for their proposed work under small spacecraft in addition to considering Exploration customers.