NASA seeks innovative concepts for Multifunctional Autonomous Robust Sensor Systems (MARSS) to increase spacecraft autonomy and robustness. These concepts are intended to lower overall mission costs, reduce reliance on human control and monitoring, and allow for systems that are inherently robust and provide maximum flexibility of the space vehicles throughout mission lifecycle and for various space/planetary exploration missions. The systems should include the ability to couple the data from a variety of distributed sensor technologies to relevant response actuation systems of the vehicle. As we move from 10s of sensors to 1000s of sensors and beyond, new approaches must be investigated that will allow the vehicle to efficiently obtain “knowledge” about the health and optimization of its systems, and the ever changing environment it is in.

Robustness and autonomy in space vehicles are two of the keys to achieving maximum efficiency of missions and increasing the probability of success. Distributed, self-sufficient, reconfigurable sensors are at the heart of this capability. Technologies such as, but not limited to, MEMS, nanotechnology, integrated /distributed processors and fuzzy logic are potential elements of MARSS. These systems should be able to provide their own power by scavenging it from the environment and provide real-time knowledge from large numbers of sensors to various response systems to comprise “sense and respond” systems. In addition, methods are sought to improve radiation shielding of systems components. This includes, but are not limited to, metal and metal matrix materials that may offer better radiation protection properties than the current state-of-the-art aluminum alloys, and high atomic number intercalated graphite composites for light weight strong radiation shielding of electronics to improve their robustness.

Emphasis should be placed on technologies that provide a sense-and-respond capability using technologies that are small, reliable, low-cost, lightweight, and would allow space probes to adapt to a wide range of space missions. Sensing requirements include both intrinsic (relating to the performance and health of the vehicle itself) and extrinsic (relating to the performance of the mission and adapting to the operating environment).

Evaluators will be looking for system concepts and not just individual pieces that could be used for a system. This requires multidiscipline collaboration on various proposals and clear explanations of system functionality, benefit, and improvement over existing technology. In addition, details of how systems will function in relevant space environments should be provided. The Technology Readiness Level (TRL) for submissions should be in the TRL...
4-6 range. Please see the SBIR Web site for more details.