NASA SBIR 2005 Phase I Solicitation

S8.01  Guidance, Navigation and Control

Lead Center: GSFC

Participating Center(s): JPL

Future science architectures will include observation and sensing platforms of varying type, size and complexity in a number of mission-operational regimes, trajectories and orbits. Advanced Guidance Navigation and Control (GN&C) technology is required for these platforms to address high performance and reliability requirements while simultaneously satisfying low power, mass, volume and affordability constraints. In particular, there are many technology gaps in challenging orbital environments, including highly elliptical Earth orbits, libration point orbits, and lunar and planetary orbits.

A vigorous effort is needed to develop guidance, navigation and control methodologies, algorithms, and sensor-actuator technologies to enable revolutionary science missions. Of particular interest are highly innovative GN&C technology proposals directed towards enabling scientific investigators to exploit new vantage points, develop new sensing strategies, and implement new system-level observational concepts that promote agility, adaptability, evolvability, scalability, and affordability. Novel approaches for the autonomous control of distributed spacecraft and/or the management of large fleets of heterogeneous and/or homogeneous assets are desired. Specific areas of research include:

GN&C System Technologies

Innovative GN&C solutions are sought for scientific instrument and laser communication system pointing, tracking, and stabilization. Proposals that exploit and combine recent advances in, spacecraft attitude determination and control, advanced electro-mechanical packaging, MEMS technology, and ultra-low power microelectronics are encouraged. Of particular interest is technology to provide alternative solutions to challenging GN&C problems such as spacecraft relative range and attitude determination while in close formation and/or during rendezvous/proximity operations.

GN&C Sensors and Actuators

Advanced technology sensors and actuators are sought such as Sun sensors, Earth sensors, star/celestial object trackers, fine guidance sensors, gyroscopes, accelerometers, inertial measurement units, navigation devices, magnetometers, reaction/momentum wheels, control-moment gyros, magnetic torquers, tethers, attitude control thrusters, etc. These devices should have enhanced capabilities and performance as well as reduced cost, mass, power, volume, and reduced complexity for all platform GN&C system elements.
Of particular interest are technologies that will provide a sensing or actuation function, having performance (e.g., dynamic range, stability, accuracy, noise, sensitivity, bandwidth, control authority, etc.) consistent with the state-of-the-art, with significantly reduced mass, power, volume, and cost. Technologies having the potential for significantly increased performance without additional mass, power, volume, and cost are also of interest. These resource reduction and/or performance improvement factors should be quantified in the proposal and show a minimum factor of 2 with a goal of 10 or greater. Highly autonomous and robust GN&C devices with multifunctional capabilities are of particular interest.

Innovations in Global Positioning System (GPS) receiver hardware and algorithms that use GPS code and carrier signals to provide spacecraft navigation, attitude, and time. Of particular interest are GPS-based navigation techniques that may employ Wide Area Augmentation System (WAAS) corrections.

Novel approaches to autonomous sensing and navigation of multiple distributed space platforms. Of particular interest are specialized sensors and measurement systems for formation sensing and relative navigation functions.