NASA SBIR 2014 Phase I Solicitation

H9.05 Advanced Celestial Navigation Techniques and Systems for Deep-Space Applications

Lead Center: GRC

Participating Center(s): GSFC

NASA is seeking proposals to develop advanced celestial navigation techniques and system in support of deep-space missions. Advances in positioning, attitude estimation, orbit determination, time and frequency keeping and dissemination and orbit determination are sought. System and sub-system concepts should support significant advances of independence from Earth supervision including the ability to operate effectively in the absence of Earth-based transmissions or transmissions from planetary relay spacecraft while minimizing spacecraft burden by requiring low power and minimal mass and volume. While system concepts that operate in the complete absence of human intervention or Earth-based transmissions are preferred, testing and verification of proposed systems performance will, necessarily, include Earth-based systems.

Operation during all phases of mission operations, including cruise phase, orbit phase and circularization phases are of interest. An application of interest is to enable open–loop (i.e., beaconless) pointing of high rate optical communications terminals to earth terminals. Methods and systems should be sufficient accuracy to support this capability; however, concepts which are capable of supporting planetary missions of any type are of interest.

Subjects appropriate for this sub-topic include, but are not limited to:

- Advanced methods and sensors for optical/IR detection of star fields (i.e., star cameras).
- Advanced methods and sensors detecting RF and x-ray pulsars.
- Methods to process celestial observations to perform Orbit Determination (OD) and precision attitude estimation.

Proposals to develop Artificial Intelligence methods (e.g., supervisory control) should identify gaps in the knowledge base that are particular to the use of advanced celestial methods, unique to the deep space navigation problem. User spacecraft impact is of significant importance and proposed solutions include assessments of mass, power, thermal impact on targeted mission spacecraft. Current and past mission spacecraft may be used as paradigms. Proposals that include re-purposing/cross-purposing of advanced sensors contemplated for future deep-space missions such as x-ray telescopes are preferred.

Research should be conducted to demonstrate technical feasibility during Phase I and show a path toward a Phase II hardware and software demonstration unit or software package for NASA testing at the completion of the Phase II contract. Deliverables must include a phased testing, verification and validation plan. Plans that include graduated flight testing are preferred.