



NASA SBIR 2016 Phase I Solicitation

H9.03 Flight Dynamics and Navigation Systems

Lead Center: GSFC

Participating Center(s): GRC, JPL

NASA is investing in the advancement of software algorithm/stools, systems, and devices to enhance and extend its capabilities for providing position, attitude, and velocity estimates of its spacecraft as well as improve navigation, guidance and control functions to these same spacecraft. Efforts must demonstrate significant risk or cost reduction, significant performance benefit, or enabling capability.

Proposals can support mission engineering activities at any stage of development from the concept-phase/pre-formulation through operations and disposal. Applications in low Earth orbit, lunar, and deep space are in scope for this sub-topic. Proposals that could lead to the replacement of the Goddard Trajectory Determination System (GTDS), or leverage state-of-the-art capabilities already developed by NASA such as the General Mission Analysis Tool (<http://sourceforge.net/projects/gmat/>), GPS-Inferred Positioning System and Orbit Analysis Simulation Software, (<http://gipsy.jpl.nasa.gov/orms/goal/>), Optimal Trajectories by Implicit Simulation (<http://otis.grc.nasa.gov/>) are especially encouraged. Proposers who contemplate licensing NASA technologies are highly encouraged to coordinate with the appropriate NASA technology transfer offices prior to submission of their proposals.

In particular, this solicitation is primarily focused on NASA's needs in the following focused areas:

Guidance and Control

- Advanced optimal control methodologies for chemical and electric space flight guidance and control systems.
- Numerical methods and solvers for robust targeting, and non-linear, constrained optimization problems.
- Applications of advanced dynamical theories to space mission design and analysis, in the context of unstable orbital trajectories in the vicinity of small bodies and libration points.
- Advanced guidance and control techniques that support autonomous, on-board applications.

Navigation

- Applications of cutting-edge estimation techniques to spaceflight navigation problems.
- Applications of estimation techniques that have an expanded state vector (beyond position, velocity, and/or attitude components) or that employ data fusion.
- Advanced autonomous navigation techniques including devices and systems that support significant advances in independence from Earth supervision while minimizing spacecraft burden by requiring low power and minimal mass and volume.
- Advanced time and frequency keeping and dissemination

Software

- Addition of novel guidance, navigation, and control improvements to existing NASA software that is either freely available via NASA Open Source Agreements, or that is licensed by the proposer.
- Interface improvements, tool modularization, APIs, workflow improvements, and cross platform interfaces for software that is either freely available via NASA Open Source Agreements, or that is licensed by the proposer that provide significant cost or performance benefits

Phase I research should be conducted to demonstrate technical feasibility, with preliminary software being delivered for NASA testing, as well as show a plan towards Phase II integration. For proposals that include hardware development, delivery of a prototype under the Phase I contract is preferred, but not necessary.

With the exception listed below for heritage software modifications, Phase II new technology development efforts shall deliver components at the TRL 5-6 level with mature algorithms and software components complete and preliminary integration and testing in an operational environment. For efforts that extend or improve existing NASA software tools, the TRL of the deliverable shall be consistent with the TRL of the heritage software. Note, for some existing software systems (see list above) this requires delivery at TRL 8. Final software, test plans, test results, and documentation shall be delivered to NASA.