



NASA SBIR 2011 Phase I Solicitation

04.03 Flight Dynamics Technologies and Software

Lead Center: GRC

Participating Center(s): ARC, GSFC, JPL

NASA is beginning to invest in re-engineering its suite of tools and facilities that provide navigation and mission design services for design and operations of mid-term and long-term near-Earth and interplanetary missions. This solicitation seeks proposals that will develop the highly desired flight dynamics technologies and software that support these efforts.

Proposals that leverage state-of-the-art capabilities already developed by NASA are especially encouraged, such as:

- GPS-Enhanced Onboard Navigation Software: http://techtransfer.gsfc.nasa.gov/ft_tech_gps_navigator.shtm.
- General Mission Analysis Tool: <http://sourceforge.net/projects/gmat/>.
- GPS-Inferred Positioning System and Orbit Analysis Simulation Software: <http://gipsy.jpl.nasa.gov/orms/goa/>.
- Optimal Trajectories by Implicit Simulation: <http://otis.grc.nasa.gov/>.

Proposers who contemplate licensing NASA technologies are highly encouraged to coordinate with the appropriate NASA technology transfer offices prior to submission of their proposals.

Areas of interest: In the context of this solicitation, flight dynamics technologies and software are algorithms and software that may be used in ground support facilities, or onboard a spacecraft, so as to provide Position, Navigation, and Timing (PNT) services that re-duce the need for ground tracking and ground navigation support. Flight dynamics technologies and software also provide critical support to pre-flight mission design, planning, and

analysis activities.

This solicitation is primarily focused on NASA's operational needs in the following focused areas:

- Applications of cutting-edge estimation techniques, such as, but not limited to, sigma-point and particle filters, to spaceflight navigation problems.
- Applications of estimation techniques that have an expanded state vector (beyond position and velocity components) to monitor non-Gaussian state noise processes and/or non-Gaussian measurement noise processes.
- Applications of estimation techniques that combine measurements from multiple sensor suites in a highly coupled manner to improve upon the overall system accuracy.
- Addition of novel estimation techniques to existing NASA mission design software that is either freely available via NASA Open Source Agreements, or that is licensed by the proposer.
- Applications of advanced dynamical theories to space mission design and analysis, especially in the context of unstable orbital trajectories in the vicinity of small bodies and libration points.
- Addition of novel measurement technologies to existing NASA onboard navigation software that is licensed by the proposer.
- Addition of orbit determination capabilities to existing NASA mission design software that is either freely available via NASA Open Source Agreements, or that is licensed by the proposer.

Technologies and software should support a broad range of spaceflight customers. Technologies and software specifically focused on a particular mission's or mission set's needs, for example rendezvous and docking, or formation flying, are the subject of other solicitations by the relevant sponsoring organizations and should not be submitted in response to this solicitation.

For all above technologies, research should be conducted to demonstrate technical feasibility during Phase I (to reach TRL 3) and show a path toward Phase II hardware and software demonstration and delivering a demonstration unit or software package for NASA testing at the completion of the Phase II contract (to reach TRL 5).

Phase I Deliverables:

- Midterm Technical Report.
- Final Phase I Technical Feasibility Report with a Phase II Integration Path.

Phase II Deliverables:

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- Final Phase II Technical Report.
 - Algorithm Specification.
 - Delivery of software package.
 - Demonstration of software package.