NASA SBIR 2018 Phase I Solicitation

H9.03 Flight Dynamics and Navigation Technology

Lead Center: GSFC

Participating Center(s): MSFC

Technology Area: TA5 Communication and Navigation

Future NASA missions will require precision landing, rendezvous, formation flying, cooperative robotics, proximity operations (e.g., servicing), and coordinated platform operations. This drives the need for increased precision in absolute and relative navigation solutions, and more advanced algorithms for both ground and onboard guidance, navigation, and control.Â This subtopic seeks advancements in flight dynamics and navigation technology for applications in Earth orbit, lunar, and deep space that enables future NASA missions.Â In particular, technology relating to navigation, autonomous onboard guidance, navigation and control, and trajectory optimization are solicited. Â Â

Autonomous, On-Board Guidance, Navigation and Control**:**

- 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.
- Onboard trajectory planning and optimization algorithms, for real-time mission re-sequencing, on-board computation of large divert maneuvers (TA 5.4.2.3, TA 5.4.2.5, TA 5.4.2.6, TA 9.2.6) primitive body/lunar proximity operations and pinpoint landing (TA 5.4.6.1).
- Rendezvous targeting (TA 4.6.2.1) Proximity Operations/Capture/ Docking Guidance (TA 4.6.2.2).

Advanced Techniques for Trajectory Optimization**:**

- Tools and techniques for distributed space missions including constellations and formations (TA 11.2.6).
- Low-thrust trajectory optimization in a multi-body dynamical environment (TA 5.4.2.1).
- Advanced deep-space trajectory design techniques. (TA 5.4.2.7) and rapid trajectory design near small bodies (TA 5.4.5.1).

Additional Scope ClarificationÂ

Efforts must demonstrate significant risk or cost reduction, significant performance benefit, or enabling capability.Â Note that implementation of well understood GN&C algorithms into hardware/software, and high TRL activities, are not in scope. Â

Proposals that leverage state-of-the-art capabilities already developed by NASA, or that can optionally integrate with those packages, such as the General Mission Analysis Tool (http://sourceforge.net/projects/gmat/), Goddard Enhanced Onboard Navigation System (GEONS)Â (https://software.nasa.gov/software/GSC-14687-1), 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/) , and Navigator (http://itpo.gsfc.nasa.gov/wp-content/uploads/gsc_14793_1_navigator.pdf),Â or other available hardware and software tools are encouraged.Â Proposers who contemplate licensing NASA technologies are highly encouraged to coordinate with the appropriate NASA technology transfer offices prior to submission of their proposals.

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.Â For proposals that include hardware development, delivery of a prototype under the Phase I contract is preferred, but not necessary.Â 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.