H9.04   Flight Dynamics GNC Technologies and Software

Lead Center: GSFC

Participating Center(s): GRC, JPL

NASA is investing in re-engineering its suite of tools and facilities that provide guidance, navigation, and control (GNC) services for the design, development, and operation of near-Earth and interplanetary missions. This solicitation seeks proposals that will develop ground system algorithms and software for flight dynamics GNC technologies to support engineering activities from concept development through operations and disposal. This subtopic does not target on-board algorithms or software.

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

- Addition of advanced guidance, navigation, and control improvements to existing NASA software.
- Replacement of heritage GNC software systems that are nearing obsolescence or improvement of their maintainability.
- Interface improvements, tool modularization, APIs, workflow improvements, and cross platform interfaces to existing NASA software.
- Applications of optimal control theory to high and low thrust space flight guidance and control systems.
- Numerical methods and solvers for robust targeting, and non-linear, constrained optimization.
- Applications of cutting-edge estimation techniques to spaceflight navigation problems.
- Applications of cutting-edge guidance and control techniques to space trajectories.
- 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.

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 (gmatcentral.org), GPS-Inferred Positioning System and Orbit Analysis Simulation Software, (http://gipsy.jpl.nasa.gov/orms/goa/), Optimal Trajectories by Implicit Simulation (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.

Technologies and software should support a broad range of spaceflight customers. Those that are focused on a particular mission's or mission set's needs are the subject of other solicitations by the relevant sponsoring organizations and should not be submitted in response here.

Phase I efforts shall demonstrate technical and cost feasibility at the TRL 3 level and provide a plan for completion of the effort in Phase II. Preliminary software, algorithms, and documentation shall be delivered to NASA for evaluation.

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.