



## NASA SBIR 2008 Phase I Solicitation

### S3.01 Avionics and Electronics

Lead Center: GSFC

Participating Center(s): ARC, GRC, JPL, JSC, LaRC

NASA's space based observatories, fly by spacecraft, orbiters, landers, and robotic and sample return missions, require robust command and control capabilities. Advances in technologies relevant to guidance, navigation, command and data handling are sought to support NASA's goals and several missions and projects under development (<http://nasascience.nasa.gov/search?SearchableText=missions+under+development>, [http://www.nap.edu/catalog.php?record\\_id=10432](http://www.nap.edu/catalog.php?record_id=10432)).

The subtopic goals are to: (1) develop high-performance processors and memory architectures and reliable electronic systems, (2) develop an avionics architecture that is flexible, scalable, extensible, adaptable, and reusable, (3) develop precision line-of-sight sensing for large telescopes and spacecraft formations, and (4) mass and technology improvements in guidance, navigation and control for low cost small spacecraft use. The subtopic objective is to elicit novel architectural concepts and component technologies that are realistic and operate effectively and credibly in environments consistent with the future vision of the Science Mission Directorate.

Successful proposal concepts will significantly exceed the present state-of-the-art. Proposals will clearly (1) state what the product is; (2) describe how it targets the technical priorities listed below; and (3) outline the feasibility of the technical and programmatic approach. If a Phase 2 proposal is awarded, the combined Phase 1 and Phase 2 developments shall produce a prototype that is testable by NASA. The technology priorities sought are listed below.

#### Command and Data Handling

- Processors - General purpose (processor chips and radiation-hardened by design synthesizable IP cores) and special purpose single-chip components (DSPs) with sustainable processing performance and power efficiency (>500 MIPS at >100 MIPS/W for general purpose processing platforms, >5 GMACs at >5 GMACS/W for computationally-intensive processing platforms), and tolerance to total dose and single-event radiation effects. Concepts must include tools required to support an integrated hardware/software development flow.
- Radiation-hardened non-volatile low power memories and Ethernet physical layer components.
- Tunable, scalable, reconfigurable, adaptive fault-tolerant avionics.

#### Guidance, Navigation and Control

- Navigation systems (including multiple sensors and algorithms/estimators, possibly based on existing component technologies) that work collectively on multiple vehicles to enable inertial alignment of the

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formation of vehicles (i.e., pointing of the line-of-sight defined by fixed points on the vehicles) on the level of milli-arcseconds relative to the background star field.

- Light-weight sensors (gyroscopic or other approach) to enable milli-arcsecond class pointing measurement for individual large telescopes and low cost small spacecraft.
- Isolated pointing and tracking platforms (pointing 0.5 arcseconds, jitter to 5 milli-arcsecond), targeted to placing a scientific instrument on GEO communication satellites that can track the sun for > 3 hours/day.
- Working prototypes of GN&C actuators (e.g., reaction or momentum wheels) that advance mass and technology improvements for small spacecraft use. Such technologies may include such non-contact approaches such as magnetic or gas. Superconducting materials, driven by temperature conditioning may also be appropriate provided that the net power used to drive and condition the "frictionless" wheels is comparable to traditional approaches.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.

The Small Spacecraft Build effort highlighted in Topic S4 (Low-cost Small Spacecraft and Technologies) of the solicitation participates in this subtopic. Offerors are encouraged to take this in consideration as a possible flight opportunity when proposing work to this subtopic.