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, including the New World Observer, GEO Quick Ride and Radiation Hardened Electronics for Space Environments (RHESE).

The subtopic goals are to: (1) develop high-performance processors and memory architectures and reliable electronic systems and (2) develop precision line-of-sight sensing for large telescopes and spacecraft formations. 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 (SMD).

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 and FPGAs) with sustainable processing performance (>500 MIPS), power efficiency (>100 MIPS/W) and radiation tolerance, including the tools to support the
software flow.

- Radiation hardened: low power memories and Ethernet physical layer components.
- Models for analysis of interplanetary radiation and radiation belts, and technologies enabling in-flight total dose and single event radiation measurements.

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 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.
- 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.