NASA SBIR 2018 Phase I Solicitation

S3.04 Guidance, Navigation and Control

Lead Center: GSFC

Participating Center(s): ARC, JPL, LaRC, MSFC

Technology Area: TA4 Robotics, Telerobotics and Autonomous Systems

NASA seeks innovative, groundbreaking, and high impact developments in spacecraft guidance, navigation, and control technologies in support of future science and exploration mission requirements. This subtopic covers mission enabling technologies that have significant Size, Weight and Power, Cost, and Performance (SWaP-CP) improvements over the state of the art COTS in the areas of Spacecraft Attitude Determination and Control Systems, Absolute and Relative Navigation Systems, and Pointing Control Systems, and Radiation-Hardened GN&C Hardware.

Component technology developments are sought for the range of flight sensors, actuators, and associated algorithms and software required to provide these improved capabilities. Technologies that apply to most spacecraft platform sizes will be considered.

Advances in the following areas are sought:

- *Spacecraft Attitude Determination and Control Systems* - Sensors and actuators that enable <0.1 arcseond level pointing knowledge and arcsecond level control capabilities for large space telescopes, with improvements in size, weight, and power requirements.
- *Absolute and Relative Navigation Systems* - Autonomous onboard flight navigation sensors and algorithms incorporating both spaceborne and ground-based absolute and relative measurements. For relative navigation, machine vision technologies apply. Special considerations will be given to relative navigation sensors enabling precision formation flying, astrometric alignment of a formation of vehicles, robotic servicing and sample return capabilities, and other GN&C techniques for enabling the collection of distributed science measurements.
- *Pointing Control Systems* - Mechanisms that enable milli-arcsecond class pointing performance on any spaceborne pointing platforms. Active and passive vibration isolation systems, innovative actuation feedback, or any such technology that can be used to enable other areas within this subtopic applies.
- *Radiation-Hardened Hardware:Â * GN&C sensors that could operate in a high radiation environment, such as the Jovian environment.
- *Fast light Gyroscopes and Accelerometers* - In conventional ring laser gyros, precision increases with cavity size and measurement time. Fast-light media, however, can be used to increase gyro precision without having to increase size or decrease measurement frequency, thereby increasing the time for standalone spacecraft navigation. (The increased precision also opens up new science possibilities such as measurements of fundamental physical constants, improving the sensitivity-bandwidth product for gravity wave detection, and tests of general relativity.) Prototype fast-light gyros are sought that can be

implemented in a compact rugged design that is tolerant to variations in temperature and G-conditions, with the ultimate goal of demonstrating decreased angular random walk.

Phase I research should be conducted to demonstrate technical feasibilityÂ as well as show a plan towards Phase II integration and component/prototype testing in a relevant environment. Â Phase IIÂ technology development efforts shall deliver component/prototypeÂ at the TRL 5-6 level consistent with NASA SBIR/STTR Technology Readiness Level (TRL) Descriptions. Delivery of final documentation, test plans,Â and test results are required.Â Delivery of a hardware component/prototype under the Phase IIÂ contract is preferred.

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