



NASA SBIR 2011 Phase I Solicitation

S5.04 Spacecraft Technology for Sample Return Missions

Lead Center: GRC

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

NASA plans to perform sample return missions from a variety of targets including Mars, outer planet moons, and small bodies such as asteroids and comets. In terms of spacecraft technology, these types of targets present a variety of challenges. Some targets, such as Mars and some moons, have relatively large gravity wells and will require ascent propulsion. Other targets are small bodies with very complex geography and very little gravity, which present difficult navigational and maneuvering challenges. In addition, the spacecraft will be subject to extreme environmental conditions including low temperatures (120K or below), dust, and ice particles. Technology innovations should either enhance vehicle capabilities (e.g., increase performance, decrease risk, and improve environmental operational margins) or ease mission implementation (e.g., reduce size, mass, power, cost, increase reliability, or increase autonomy). Specific areas of interest are listed below.

SMD's In-Space Propulsion Technology (ISPT) program is a direct customer of this subtopic, and the solicitation is coordinated with the ISPT program each year. The ISPT program views this subtopic (and the previous Planetary Ascent Vehicle subtopic) as a fertile area for providing possible Phase III efforts. Many of the Planetary Decadal Survey white papers/studies evaluating technologies needed for various planetary, small body, and sample return missions refer to the need for sample return spacecraft technologies.

Small body missions:

- Autonomous operation.
- Terrain based navigation.
- Guidance and control technology for landing and touch-and-go.
- Anchoring concepts for asteroids.
- Propulsion technology for proximity or landed operations.

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- Low temperature capable non-contaminating propellants.
 - Surface manipulation technologies (e.g., rakes, drills, etc.).
 - Concept to obtain a stratified subsurface comet core sample.
 - Sample mass, volume, ice content verification.
 - Hermetic sample sealing concepts.
 - Low power long life cryogenic sample storage.
 - Applicable propulsion technologies for ascent vehicles and for the return to Earth.
 - Erection mechanisms for setting azimuth and elevation of the Mars Ascent Vehicle.