The Science Mission Directorate (SMD) needs spacecraft with ever-increasing propulsive performance and flexibility for ambitious missions requiring high duty cycles and years of operation. Planetary spacecraft need the ability to rendezvous with, orbit, and conduct in situ exploration of planets, satellites and other solar system bodies. Platforms, satellites, and satellite constellations have high-precision propulsion requirements, usually in volume- and power-limited envelopes. This subtopic seeks innovations to meet SMD propulsion requirements, reflecting the goals of NASA’s In-Space Propulsion Technology program to reduce the travel time, mass, and cost of SMD spacecraft. Propulsion areas include chemical and electric propulsion systems, propulsion technologies related to sample return missions to asteroids, comets, and other small bodies, propellantless options (such as aerocapture and solar sails), and less developed but emerging propulsion concepts such as advanced plasma thrusters and momentum exchange/electrodynamic reboost (MXER) tethers.

Specifically, innovations are sought in the following areas:

- Characterization of high strength fibers and compatible resins for composite overwrapped pressure vessels (COPVs) for use in higher-pressure, in-space propulsion systems. Of particular interest are fiber/resin systems exhibiting high uniformity of mechanical properties and high resistance to debonding.

- Improved capability and reduced cost of low- to medium-power electric propulsion systems, including power processing, long-life, high-efficiency cathodes and neutralizers, low-erosion materials for ion optics and Hall discharge chambers, plume mitigation, and next generation thrusters.

- Thin film materials, elastomeric materials, and/or high temperature fabrics for inflatable decelerator concepts used in aerocapture applications at planetary destinations. The decelerator will be stowed for many years (up to 10 years) in an uncontrolled space environment (-130°C). The inflatable decelerator will experience temperatures up to 500°C during the aerocapture maneuver. Materials of particular interest include polyimide thin films, polybenzobisoxazole (PBO) thin films, and ceramic fabrics.