X2.02 Non-Toxic In-Space Propulsion

This solicitation intends to examine a range of key technology options associated with cryogenic and non-toxic storable propellant space engines. Non-toxic engine technology is desired for use in lieu of the currently operational NTO/MMH engine technology. Safety concerns with toxic propellants drive mission planners to the use of more costly propulsion modules that are fueled and sealed on the ground. Non-toxic engine technologies could range from reaction control class of 25-1000 lbf to main engines of up to 60,000 lbf with both pump fed or pressure fed systems.

Specific technologies of interest to meet proposed engine requirements include:

- Non-toxic bipropellant or monopropellants that meet performance targets (as indicated by high specific impulse and high specific impulse density) while improving safety and reducing handling operations as compared to current state-of-the-art storable propellants.
- Low-mass propellant injectors that provide stable, uniform combustion over a wide range of propellant inlet temperature and pressure conditions.
- High temperature materials, coatings and/or ablatives for injectors, combustion chambers, nozzles, and nozzle extensions.
- Combustion chamber thermal control technologies such as regenerative, transpiration, swirl or other cooling methods, which offer improved performance and adequate chamber life.
- Technologies are also solicited that enable deep-throttling turbopumps to operate at off-design flow coefficients while eliminating flow instabilities such as cavitating surge.
- Highly-reliable, long-life, fast-acting propellant valves that tolerate long duration space mission environments with reduced volume, mass, and power requirements is also desirable.
- Cryogenic instrumentation such as pressure and temperature sensors that will operate for months/years instead of hours.

Note to Proposer: Subtopic S3.04 under the Science Mission Directorate also addresses in-space propulsion. Proposals more aligned with science mission requirements should be proposed in S3.04.