NASA STTR 2017 Phase I Solicitation

T2.01 Advanced Nuclear Propulsion

Lead Center: SSC

Participating Center(s): GRC, MSFC

Technology Area: TA2 In-Space Propulsion Technologies

The objective of this subtopic is to advance low TRL (<3) nuclear propulsion technologies that have the potential to transform space transportation and space exploration to Mars and other planets/moons in our solar system. Radical improvements in in-space propulsion technologies beyond the current state of the art (SOA) are required to enable new missions that safely transport humans and/or robotic systems with increased reliability to meet mission requirements, transport them quickly to reduce transit times and provide quicker scientific results, increase the payload mass to allow more capable instruments and larger crews, and reduce the overall mission cost. SOA in-space transportation systems typically employ chemical propulsion or electric propulsion systems. In parallel, thought must go into how best to ground test these concepts to allow a smoother, more efficient and safer path for future development.

This subtopic specifically seeks proposals for innovative research and development of advanced nuclear propulsion technologies that have the potential for significant improvement over the current SOA, primarily to achieve:

- High specific impulse (Isp) and thrust-to-weight ratio (T/W) to consume less propellant and provide shorter trip times.

Other design requirements to consider in the proposed concept include:

- Low system mass and volume (includes propellant, power system, thermal control/radiators) to reduce the total mass and number of launches to orbit.
- Safety, affordability, and reliability

Most of the known advanced nuclear propulsion candidate technologies are listed in the 2015 NASA OCT Roadmap TA02: In-Space Propulsion Technologies (http://www.nasa.gov/offices/oct/home/roadmaps/index.html). Advanced nuclear propulsion technologies are identified in section 2.3.3 Fusion Propulsion, section 2.3.5 Antimatter Propulsion, and section 2.3.6 Advanced Fission. Technology SOA and technical challenges are included for each.

Other advanced nuclear propulsion technologies not listed in the 2015 OCT TA02 Roadmap are welcome and within the scope of the subtopic (e.g., various nuclear hybrid concepts), including novel system and component ground test approaches and associated supporting/enabling technologies.

Proposed technologies must be theoretically credible and proposals must describe how the technology will make a

significant improvement over SOA in-space propulsion systems. Proposals must describe the ultimate objective of the effort and detail the planned investigative approach. The planned experimentation should be described, including the test equipment to be used and/or developed. The proposal should describe the development risks and mitigation plans.

Proposals should strive to advance the proposed technology to TRL 3: perform experimental critical function and/or proof-of-concept. If a significant increase in the TRL of a particular propulsion technology is not realizable, the proposal should clearly indicate the value proposition of the proposed effort to mature the candidate technology in the context of an overall development plan, describing how the award would support the maturation of the technology through phase II.