NASA STTR 2017 Phase I Solicitation

T15.01 Distributed Electric Propulsion Aircraft Research

Lead Center: AFRC

Participating Center(s): ARC, GRC, LaRC

Technology Area: TA15 Aeronautics

Distributed Electric Propulsion (DEP) Aircraft employ multiple electric propulsors to achieve unprecedented performances in air vehicles. The propulsor could be ducted/un-ducted fans, propellers, cross-flow-fans, etc. Some of the benefits identified using this propulsion system are reductions in fuel burn/energy usage, noise, emissions, and/or field length. Addressing ARMD's Strategic Thrust #3 (Ultra-Efficient Commercial Vehicles) and #4 (Transition to Low-Carbon Propulsion), innovative approaches in designing and analyzing the DEP aircraft are investigated and encouraged. In support of these two Strategic Thrusts, the following DEP aircraft research areas are to be considered under this solicitation.

- *Explore Subsonic Fixed Wing Aircraft Concepts with the DEP System* - Vehicle classes are to be from small on-demand aircraft to large subsonic transport aircraft. The study shall include vehicle system level assessment including feasibility, design, and benefits assessment.
- *Develop Analytical Tools and Methods to Assess DEP Aircraft Concepts* – Assessing a feasibility of vehicle concept requires reliable analytical, computational, experimental, and/or simulation tools and methods. Since the DEP aircraft involve multi-disciplinary subjects, some form of optimization process will be preferred and needed.
- *Assess Propulsion Airframe Integration (PAI) Benefits* – Synergistic benefit assessment capability needs to be established for aircraft with the DEP system. Some of the PAI examples include boundary layer ingestion (BLI), aero-propulsive acoustics, induced drag reduction using wing-tip propulsor, use of DEP coupled aeroelasticity effects to improve vehicle performance, etc.
- *Develop Aircraft Control Concept using DEP* – Aircraft control using differential and/or thrust vectoring of distributed electric propulsors shall be explored. This may allow reduction or elimination of conventional aerodynamic control surfaces.

Expected outcome (TRL 2-3) of Phase I awards, but not limited to:

- DEP aircraft concept definition and system level assessment.
- Initial development of analytical/computational/experimental/simulation tools and methods in assessing DEP concepts and aircraft.

Expected outcome (TRL 4-6) of Phase II awards, but not limited to:

- Detailed feasibility study and demonstration of the subscale hardware.

- Refinement of tools and methods in assessing DEP concepts and aircraft.
- Experimental (e.g., wind tunnel) results that assess the validity of the DEP/aircraft concept.