# NASA SBIR 2018 Phase I Solicitation

## A3.02 Increasing Autonomy in the National Airspace Systems (NAS) (not vehicles)

**Lead Center: ARC**

**Participating Center(s): LaRC**

**Technology Area: TA15 Aeronautics**

NASA's research envisions future concepts for air transportation that will significantly expand the current nature of airspace and vehicle management with an increasing reliance on autonomy technologies. Growing numbers of operations and a wider range of vehicle performance and mission goals will not be realizable in the current airspace system, and it is expected that a new service-based architecture, with features derived from NASA's Unmanned Aircraft System (UAS) Traffic Management (UTM) model, will provide the flexibility to support future use cases while establishing the necessary constraints to ensure safe and equitable operations. New technologies will be used to empower user decision making and collaboration with other users and the Air Navigation Service Provider. NASAâ€™s near-term goal for UTM itself is the development and demonstration of the concept to safely enable low-altitude airspace and UAS operations within the next five years. For the longer-term (10 to 15 years in the future), the goal is to safely enable the anticipated dramatic increase in density of all low-altitude airspace operations. NASA is partnered with other government agencies, industry, and academia, to perform the research, development, testing, and implementation of UTM.Â

This subtopic addresses the application of autonomy towards improving mobility, scalability, efficiency, safety, and cost-competitiveness, with particular attention towards the needs of emergent users and their operations (e.g., frequent, domestic supersonic flights, and commercial space launches to Urban Air Mobility andÂ regionalÂ air-taxi operations) and enabling human operators to efficiently and effectively manage civilian low-altitude unmanned aircraft system (UAS) operations (UAS traffic management, or UTM) across a range of potential use cases (e.g., public safety/search and rescue, infrastructure inspection/surveillance, agricultural applications, cargo delivery, hobbyist, etc.). Proposals in the following areas are sought, but are not limited to:

- Autonomous or increasing levels of autonomy for, or towards, managing networked vehicle cockpits in all airspace domains (e.g., airport, metroplex, en route, regional/national traffic flow management, integration of multiple domains, on-demand aircraft and operations, and non-towered airports and vertiports).
- Autonomicity (or self-management) -based architectures for the entirety, or parts, of airspace operations.
- Autonomous systems to produce any of the following system capabilities:
    - Prognostics, data mining, and data discovery to identify opportunities for improvement in airspace operations.
    - Weather-integrated flight planning, rerouting, and execution.
    - Fleet, crew, and airspace management to reduce the total cost of operations.
    - Predictions of unsafe conditions for vehicles, airspace, or dispatch operations.
    - Performance driven, all-operations, human-autonomy teaming management.
    - Verification and validation tools for increasingly autonomous operations.

    - Machine learning and/or self-learning algorithms for Shadow Mode Assessment using Realistic Technologies for the National Airspace System (NAS).
    - Autonomy/autonomous technologies and concepts for trajectory management and efficient/safe traffic flows.
- Service-based architecture designs that enable dense urban mobility operations and/or increasingly complex operations at ultra-high altitudes.
- Dynamic route planning that considers changing environmental conditions, vehicle performance and endurance, airspace congestion, and traffic avoidance.
- Dynamic scheduling for on-demand access to constrained resources and interaction between vehicles with starkly different performance and control characteristics.
- Autonomous and safe UAS operations for the last and first 50 feet, under diverse weather conditions.
- Integration of emergent users with legacy users, large commercial transport, including pass-through to and from ultra-high altitudes and interactions around major airports.
- Operational concepts for future vehicle and missions, including vehicle performance, vehicle fleet and network management, market need and growth potential, for futureÂ operations andÂ airspace integration.
- Identification of potential certification approaches for new vehicles (such as electric vertical take-off-and landing-VTOL).
- Technologies to demonstrate the scalability of the UTM concept to potentially 10M+ users/operators.
- The development of low size, weight, and power sense-and-avoid technologies for safe, heterogeneous (manned/unmanned) aircraft operations in the National Airspace System.
- The development of UTM-focused track and locate functions.