Scope Description

In addition to pioneering air traffic management research and development in conventional, commercial and traditional airspace environments, NASA is exploring airspace operations incorporating unmanned vehicles and novel operations occurring in all airspaces (controlled and uncontrolled), with a goal to safely and efficiently integrate with existing operations and mission types. NASA’s research to enable unmanned vehicles to be safely and fully integrated into existing airspace structures (or lack thereof) has already demonstrated the potential benefits and capabilities of a service-based architecture (such as developed for the Unmanned Aircraft Systems Traffic Management [UTM] Research and Development [R&D] evaluations), and has led to new procedures, equipage and operating requirements and policy recommendations, to enable widespread, harmonized, equitable execution of diverse unmanned missions.

This subtopic welcomes proposals continuing to support and develop the UTM concept which seeks technologies to enable safe, heterogeneous (manned/unmanned) operations including, but not limited to, the following:

- To demonstrate the scalability of the UTM concept to potentially 10M+ users/operators
- To enable low size, weight, and power sense-and-avoid technologies
- The development of UTM-focused track and locate functions
- Autonomous and safe Unmanned Aircraft Systems (UAS) operations for the last and first 50 feet under diverse weather conditions

This subtopic also welcomes proposals supporting the Urban Air Mobility (UAM) concept, which seeks technologies including, but not limited to, the following:

- 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
- 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 future operations and airspace integration
• Identification of potential certification approaches for new vehicles operations (such as electric vertical take-off-and landing)

References

https://www.nasa.gov/aeroresearch/programs/aosp
https://www.aviationsystemsdivision.arc.nasa.gov/publications/index.shtml
https://www.aviationsystemsdivision.arc.nasa.gov/index.shtml
https://www.nasa.gov/aeroresearch/strategy

Expected TRL or TRL range at completion of the project: 1 to 4

Desired Deliverables of Phase II

Prototype, Analysis, Software, Research

Desired Deliverables Description

Technologies that can advance safe and efficient growth in global operations (ARMD Thrust 1 Goal) as well as developing autonomy applications for aviation (as under ARMD Thrust 6), that are specifically applicable to UTM and/or UAM operations.

State of the Art and Critical Gaps

Current state of the art: The proposed research and development area previously resided as a subset of existing subtopic (A3.02) Autonomy of the National Airspace System (NAS). This has made this subtopic too unwieldy in trying to capture both fundamental research supporting increasing autonomy in the NAS as well as technologies that can support or expand existing efforts in unmanned vehicles research, in particular UAS Traffic Management (UTM) and Urban Air Mobility (UAM) areas.

The state-of-the-art also covers the initial stages of UTM and UAM technology development.

Critical gaps: As identified in the Scope description, technologies are needed to expand from NASA-developed prototype testing conditions to technologies that would enable broader system capabilities, and achieve increased system robustness, scalability and agility to meet various mission needs.

Relevance / Science Traceability

Airspace Operations and Safety Program (AOSP)

Air Traffic Management eXploration (ATM-X) Project

Unmanned Aircraft Systems Traffic Management (UTM) Project

Successful technologies in this subtopic will help NASA pioneer UTM and UAM concepts and technologies. The technologies also incorporate new autonomy/artificial intelligence/data science methods and approaches to air transportation problems for current and near-future application.