Scope Title

Human-Autonomy Teaming in the National Airspace System (NAS)

Scope Description

In current airspace operations, human operators occupy extensive decision-making capabilities and perform the most significant roles in the National Airspace System (NAS). As more autonomous system capabilities are introduced in air transportation, a critical research question for future airspace operations is the appropriate allocation of tasks and functions for the human operators and future autonomous systems, as they seamlessly team together to achieve common goals.

This collaboration between the human-operator and the autonomous technology, also known as “human-autonomy teaming,” is the primary focus of this subtopic.

NASA’s future concepts of air transportation (2030 and beyond) are anticipated to increasingly rely on autonomy, artificial intelligence, and machine learning, to maintain operational efficiency and safety, dynamically accommodating changes to environmental and operational conditions. The future concepts will significantly expand the capabilities of airspace operations and vehicle management to ensure safe, secure, and equitable operations, assuming seamless, integrated, flexible, and robust systems, resilient and resistant to cyber-attack. The future concepts include traditional and nontraditional vehicle types and operations, along with diverse airspace domains and mission types, and a service-based architecture to provide user services, as appropriate. Examples of such service-based systems include those demonstrated within NASA’s Unmanned Aircraft Systems Traffic Management (UTM) and the Air Traffic Management – eXploration (ATM-X) Urban Air Mobility (UAM) Projects.

This subtopic seeks proposals that will apply novel and innovative solutions to technologies, methods, and approaches to developing tools and/or technologies that will enable successful human-autonomy teaming in the future NAS (2030 and beyond).

Proposals that do not address or consider the human operator’s interaction with future, autonomous, NAS technologies will be rejected.

Expected TRL or TRL Range at completion of the Project

1 to 4
Primary Technology Taxonomy

Level 1

TX 16 Air Traffic Management and Range Tracking Systems

Level 2

TX 16.3 Traffic Management Concepts

Desired Deliverables of Phase I and Phase II

- Research
- Analysis
- Prototype
- Software

Desired Deliverables Description

Technologies that can advance safe and efficient growth in global operations (Aeronautics Research Mission Directorate (ARMD) Thrust 1 Goal) as well as developing autonomy applications for aviation (as under ARMD Thrust 6).

Phase I deliverables may take the form of a prototype/proof-of-concept decision support tool, automation and/or service, a proof-of-concept demonstration of the underlying architecture, and/or validation of the approach taken, which shows focus on a particular aspect or use case of the research and development (R&D) challenge being investigated. Phase II deliverables would presumably take the form of higher TRL tools/decision support services that convincingly demonstrate a solution to the proposed R&D challenge.

State of the Art and Critical Gaps

State of the Art: NASA has been researching advanced air transportation concepts and technologies to improve commercial operations in the NAS. Autonomy is the focus of increased ARMD interest as evidenced in Thrust 6, Assured Autonomy for Aviation Transformation. Airspace Operations and Safety Program (AOSP) research is increasingly applying autonomous technologies and capabilities towards air transportation challenges. These technologies and capabilities may address limited solutions to targeted problems.

Critical Gaps: The growth of data sciences and autonomy/artificial intelligence technologies continue to have great potential to benefit the development of a more autonomous air transportation system. This is needed to accommodate the increasing demand and diversity of air transportation missions and operations. The interpretation and use of data-science-based information by human operators and decision makers, continues to be of interest.

This subtopic is focused on the human-autonomy teaming of the airspace operations in the future NAS. Proposals that do not address the human operator interaction with future NAS technologies will be declined.

Relevance / Science Traceability

Relevance to AOSP.

Successful technologies in this subtopic have helped to advance the air traffic management/airspace operations objectives of the AOSP Program. The technologies also introduce new autonomy/artificial intelligence/data science methods and approaches to air transportation problems for current and near-future application, and show where such approaches are/are not appropriate to advance airspace operations.

References:
