NASA SBIR 2020 Phase I Solicitation

A3.02 Increasing Autonomy in the National Airspace System (NAS)

Lead Center: ARC

Participating Center(s): LaRC

Technology Area: TA15 Aeronautics

Scope Description

NASA's future concepts for air transportation will significantly expand the capabilities of airspace and vehicle management and are anticipated to increasingly rely on autonomy and/or artificial intelligence to ensure safe and equitable operations. Such future concepts propose a seamless, integrated, flexible and robust set of systems that are anticipated to include:

- Traditional as well as novel vehicle types: Unmanned Aircraft Systems (UAS), Urban Air Mobility (UAM), supersonic vehicles and space transportation vehicles
- All airspace domains and operations: airport, metroplex, en route, regional/national traffic flow management, integration of multiple domains, on-demand aircraft and operations, and non-towered airports, vertiports, spaceports, ramps and airline operations centers
- All mission types: commercial passenger, cargo transport, emergency response, surveillance, security, etc.

Further, the future concepts accommodate changes to a diverse range of environmental and operational conditions while maintaining expected safety levels.

This subtopic focuses on the future air transportation system (beyond 2025) including a widespread service-based architecture, as demonstrated within the NASA Unmanned Aircraft Systems Traffic Management (UTM) model, as appropriate.

This subtopic seeks proposals that will apply novel and innovative techniques, methods and approaches, to developing tools and/or technologies that will enable the successful transition to, or be an integral component of, the eventual realization of an autonomously operating airspace system in all airspace domains, from one in which human operators and decision-makers play a significant role.

Research and Development (R&D) challenges related to either transition or end-state autonomous airspace include:

- Transition of largely human-centric systems to human-autonomy teaming systems
- Autonomy/autonomous technologies and concepts for trajectory management and efficient/safe traffic flows
- Weather and environment-integrated flight planning, rerouting, and execution
- Fleet, crew and operator management to reduce the total cost of operations
Graceful, manageable degradation in off-nominal conditions

This subtopic is also particularly interested in proposals focused on the application of advanced data science, and non-traditional data or information sources, towards Air Traffic Management (ATM) problems while incorporating meaningful ATM domain knowledge for more sophisticated results.

References

https://www.nasa.gov/aeroresearch/programs/aosp

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).

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 National Airspace System. 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 autonomy technologies and capabilities towards air transportation challenges. These may be more limited solutions to targeted problems.

Critical Gaps: Data sciences and autonomy/artificial intelligence technologies continue to be growing areas that have great potential to benefit the development of a more autonomous air transportation system, which is expected to be needed to accommodate the increasing demand and diversity of air transportation missions and operations.

Relevance / Science Traceability

Airspace Operations and Safety Program (AOSP).

Successful technologies in this subtopic have helped to advance the air traffic management/airspace operations objectives of the 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.