NASA SBIR 2021 Phase I Solicitation

A2.03 Advanced Air Mobility (AAM) Integration

Lead Center: HQ

Participating Center(s): LaRC

Scope Title:

AAM Community Integration - Weather Infrastructure Testbed

Scope Description:

AAM is a concept for safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions. AAM includes many potential mission types (e.g., passenger transport, aerial work, and cargo transport) that may be accomplished with many different aircraft types (e.g., manned and unmanned; conventional, short, and/or vertical takeoff and landing; all electric and hybrid electric; etc.) and are envisioned to bring aviation into people’s daily lives. Although passenger-carrying urban air mobility (UAM) is an AAM mission with much investment, other AAM missions, including but not limited to “thin haul”/regional air mobility, small package delivery, and medical transport, are also of interest. Responses to this subtopic are not limited to strictly any single AAM mission.

Although limited manned, passenger-carrying UAM and other air taxi operations occur today, this market is ripe to expand as technologies such as electric propulsion and increasing autonomy converge enabling novel aircraft with enhanced capabilities. With time, the small unmanned aerial systems (sUAS) market and manned UAM and air taxi markets may converge into a broader AAM market including both manned and unmanned vehicles. To start down the path to enabling this, ARMD has proposed an organizational framework, identified a set of barriers organized according to this framework that must be overcome to enable this market, and has identified NASA’s potential contributions to overcome these market impeding barriers.

The AAM framework consists of five pillars: (1) aircraft design, (2) individual aircraft operations, (3) airspace design, (4) airspace and fleet operations, and (5) community integration. This solicitation focuses specifically on the community integration pillar (Refs 1-3, 6-8). Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

- Scope 1 Weather Data Infrastructure Testbed—Weather data sensors are part of the weather infrastructure
proposed in the UAM Maturity Level 4 (UML-4) ecosystem ConOps (concept of operations) (Refs 4 and 8). These sensors provide current weather conditions. The data they collect is an input into the UAM system for use by vehicle and vertiport operators and Providers of Services/UTM Supplemental Service Providers (PSUs/USSes) (Ref 6) and will also be utilized to validate forecasting models. This testbed should consider the innovative use of existing and new, fixed and mobile, and nontraditional weather sensors as part of the architecture; testing and validation of the accuracy of the sensors and data; new weather forecast techniques and/or ultrahigh spatial and temporal resolution weather forecast models tailored for UAM; and/or the assimilation of weather data from these sensors into weather models. The effort should consider the work being done by ASTM’s F38 WK73142 (Ref 5) and work towards a goal of increasing measurement density and scalability while incentivizing private sector companies to install weather sensing equipment, data delivery, and receive payment for the data by local government(s) and commercial Weather Supplemental Data Service Providers (SDSP) to improve UML-4 weather situational awareness and predictions. Phase I would also identify potential localities interested in hosting and utilizing the data from this testbed. Phase II would be to build the testbed in at least one locality and market for additional customers beyond those identified in Phase I.

Expected TRL or TRL Range at completion of the Project: 2 to 6

Primary Technology Taxonomy:
Level 1: TX 13 Ground, Test, and Surface Systems
Level 2: TX 13.X Other Ground, Test, and Surface Systems

Desired Deliverables of Phase I and Phase II:

- Software
- Hardware
- Analysis
- Research
- Prototype

Desired Deliverables Description:

Phase I of this SBIR would be focused on the development of an aviation metropolitan based weather sensing and prototype testbed architecture to support addressing the challenges associated with future UAM and AAM weather infrastructure. Phase I would also identify potential localities interested in hosting and utilizing the data from this testbed.

Phase II would be to build the testbed in at least one locality and market for additional customers beyond those identified in Phase I.

State of the Art and Critical Gaps:

The AAM marketplace is assessed at a UML-0 (see references). Technologies are needed to progress towards the desired UML-4 level where this model of travel is affordable to the general public.

Relevance / Science Traceability:

AAM Mission Office.

This subtopic is relevant to the Aeronautics Research Mission Directorate (ARMD) AAM Mission and the eight projects supporting that mission. Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

References:

1. NASA’s National Aeronautics Committee briefings: https://www.nasa.gov/aeroresearch/aero-nac-committee
2. George Price et al., “Urban Air Mobility Operational Concept (OpsCon) Passenger-Carrying Operations,”
NASA\CR—2020-5001587

4. Reference: Urban Weather section from the UAM UML-4 ConOps
   https://nari.arc.nasa.gov/sites/default/files/attachments/4%203%206%20Weather--CIWG%20version.pdf
5. ASTM WK731142 https://www.astm.org/DATABASE.CART/WORKITEMS/WK73142.htm
6. FAA UAM ConOps 1.0 https://nari.arc.nasa.gov/sites/default/files/attachments/UAM_ConOps_v1.0.pdf
7. National Academies Report:
   https://www.nap.edu/catalog/25646/advancing-aerial-mobility-a-national-blueprint

Scope Title:

AAM Community Integration - Urban Planning Simulation

Scope Description:

AAM is a concept for safe, sustainable, affordable, and accessible aviation for transformational local and
intraregional missions. AAM includes many potential mission types (e.g., passenger transport, aerial work, and
cargo transport) that may be accomplished with many different aircraft types (e.g., manned and unmanned;
conventional, short, and/or vertical takeoff and landing; all electric and hybrid electric; etc.) and are envisioned to
bring aviation into people's daily lives. Although passenger-carrying urban air mobility (UAM) is an AAM mission
with much investment, other AAM missions, including but not limited to “thin haul”/regional air mobility, small
package delivery, and medical transport, are also of interest. Responses to this subtopic are not limited to strictly
any single AAM mission.

Although limited manned, passenger-carrying UAM and other air taxi operations occur today, this market is ripe to
expand as technologies such as electric propulsion and increasing autonomy converge enabling novel aircraft with
enhanced capabilities. With time, the small unmanned aerial systems (sUAS) market and manned UAM and air taxi
markets may converge into a broader AAM market including both manned and unmanned vehicles. To start down
the path to enabling this, ARMD has proposed an organizational framework, identified a set of barriers organized
according to this framework that must be overcome to enable this market, and has identified NASA’s potential
contributions to overcome these market impeding barriers.

The AAM framework consists of five pillars: (1) aircraft design, (2) individual aircraft operations, (3) airspace design,
(4) airspace and fleet operations, and (5) community integration. This solicitation focuses specifically on the
community integration pillar (Refs 1-3, 6-8). Proposers seeking funding for aircraft design and individual aircraft
operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and
operations funding should submit to the A3 topic.

- Urban Planning Simulation – Develop or modify an existing city or urban planning gaming software to
  incorporate the ability to realistically simulate a multimodal transportation system that includes AAM
  transportation as an additional mode of transportation in a U.S. metropolitan area. (Ref 2)

Expected TRL or TRL Range at completion of the Project: 3 to 6
Primary Technology Taxonomy:
Level 1: TX 11 Software, Modeling, Simulation, and Information Processing
Level 2: TX 11.3 Simulation
Desired Deliverables of Phase I and Phase II:

- Software

Desired Deliverables Description:
Phase I would focus on the identification of the specific gaming software, gaining the appropriate permissions, researching the constraints associated with UAM/AAM and planned Concept of Operations (Ref 2 and 6), planning the software modifications, and developing a schedule for updates and release of the updated software.

Phase II would be the software and graphics modification and release of the updated software in accordance with the Phase I plan.

State of the Art and Critical Gaps:

Multiple urban planning games currently exist.

Relevance / Science Traceability:

AAM Mission Office.

This subtopic is relevant to the Aeronautics Research Mission Directorate (ARMD) AAM Mission and the eight projects supporting that mission. Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

References:

1. NASA’s National Aeronautics Committee briefings: https://www.nasa.gov/aeroresearch/aero-nac-committee
4. Reference: Urban Weather section from the UAM UML-4 ConOps
   https://nari.arc.nasa.gov/sites/default/files/attachments/4%203%206%20Weather--CIWG%20version.pdf
5. ASTM WK731142 https://www.astm.org/DATABASE.CART/WORKITEMS/WK73142.htm
6. FAA UAM ConOps 1.0 https://nari.arc.nasa.gov/sites/default/files/attachments/Urban_ConOps_v1.0.pdf

Scope Title:

AAM Community Integration

Scope Description:

AAM is a concept for safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions. AAM includes many potential mission types (e.g., passenger transport, aerial work, and cargo transport) that may be accomplished with many different aircraft types (e.g., manned and unmanned; conventional, short, and/or vertical takeoff and landing; all electric and hybrid electric; etc.) and are envisioned to bring aviation into people’s daily lives. Although passenger-carrying urban air mobility (UAM) is an AAM mission with much investment, other AAM missions, including but not limited to “thin haul”/regional air mobility, small package delivery, and medical transport, are also of interest. Responses to this subtopic are not limited to strictly any single AAM mission.

Although limited manned, passenger-carrying UAM and other air taxi operations occur today, this market is ripe to expand as technologies such as electric propulsion and increasing autonomy converge enabling novel aircraft with
enhanced capabilities. With time, the small unmanned aerial systems (sUAS) market and manned UAM and air taxi markets may converge into a broader AAM market including both manned and unmanned vehicles. To start down the path to enabling this, ARMD has proposed an organizational framework, identified a set of barriers organized according to this framework that must be overcome to enable this market, and has identified NASA’s potential contributions to overcome these market impeding barriers.

The AAM framework consists of five pillars: (1) aircraft design, (2) individual aircraft operations, (3) airspace design, (4) airspace and fleet operations, and (5) community integration. This solicitation focuses specifically on the community integration pillar (Refs 1-3, 6-8). Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

- The integration of AAM into a multi-modal transportation system is a complicated endeavor involving leveraging existing infrastructure, working with existing and new stakeholders in an evolving regulatory environment. The results from this SBIR would form the nucleus of a set of tools that could be utilized by local community stakeholders to support the planning, public acceptance, and analysis of various design options to incorporate AAM into the local or regional transportation system.

Expected TRL or TRL Range at completion of the Project: 1 to 4
Primary Technology Taxonomy:
Level 1: TX 11 Software, Modeling, Simulation, and Information Processing
Level 2: TX 11.X Other Software, Modeling, Simulation, and Information Processing
Desired Deliverables of Phase I and Phase II:
- Analysis
- Prototype
- Hardware
- Software

Desired Deliverables Description:
Phase I would be to identify initial needed types of data sets e.g., local zoning data and existing and needed tools, a plan to assemble or build the tools and incorporate the needed datasets, and create a business plan to market a planning suite of tools to localities to assist them to develop plans and assess the potential benefits of various site selection options and demand potential for various options for integration into the existing multimodal transportation system.

Phase II would be to execute the plans developed in Phase I.

State of the Art and Critical Gaps:
NASA has developed decision support tools for the National Airspace System. This effort would leverage that experience to support local communities.

Relevance / Science Traceability:
This subtopic is relevant to the Aeronautics Research Mission Directorate (ARMD) AAM Mission and the eight projects supporting that mission. Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

References:
1. NASA’s National Aeronautics Committee briefings:
   https://www.nasa.gov/aeroresearch/aero-nac-committee
4. Reference: Urban Weather section from the UAM UML-4 ConOps
   https://nari.arc.nasa.gov/sites/default/files/attachments/4%20Weather%20-%20CIWG%20version.pdf
5. ASTM WK731142 https://www.astm.org/DATABASE.CART/WORKITEMS/WK73142.htm
6. FAA UAM ConOps 1.0 https://nari.arc.nasa.gov/sites/default/files/attachments/UAM_ConOps_v1.0.pdf
7. National Academies Report:
   https://www.nap.edu/catalog/25646/advancing-aerial-mobility-a-national-blueprint

Scope Title:

AAM Community Integration - Multimode Transportation Information Integration

Scope Description:

AAM is a concept for safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions. AAM includes many potential mission types (e.g., passenger transport, aerial work, and cargo transport) that may be accomplished with many different aircraft types (e.g., manned and unmanned; conventional, short, and/or vertical takeoff and landing; all electric and hybrid electric; etc.) and are envisioned to bring aviation into people’s daily lives. Although passenger-carrying urban air mobility (UAM) is an AAM mission with much investment, other AAM missions, including but not limited to “thin haul”/regional air mobility, small package delivery, and medical transport, are also of interest. Responses to this subtopic are not limited to strictly any single AAM mission.

Although limited manned, passenger-carrying UAM and other air taxi operations occur today, this market is ripe to expand as technologies such as electric propulsion and increasing autonomy converge enabling novel aircraft with enhanced capabilities. With time, the small unmanned aerial systems (sUAS) market and manned UAM and air taxi markets may converge into a broader AAM market including both manned and unmanned vehicles. To start down the path to enabling this, Aeronautics Research Mission Directorate (ARMD) has proposed an organizational framework, identified a set of barriers organized according to this framework that must be overcome to enable this market, and has identified NASA’s potential contributions to overcome these market impeding barriers.

Th AAM framework consists of five pillars: (1) aircraft design, (2) individual aircraft operations, (3) airspace design, (4) airspace and fleet operations, and (5) community integration. This solicitation focuses specifically on the community integration pillar (Refs 1-3, 6-8). Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

- This effort would be to design and develop an innovative Multimodal Information Management System (MIMS) that includes AAM as one element of a Smart City transportation data management system.

Expected TRL or TRL Range at completion of the Project: 2 to 4

Primary Technology Taxonomy:
Level 1: TX 11 Software, Modeling, Simulation, and Information Processing
Level 2: TX 11.4 Information Processing

Desired Deliverables of Phase I and Phase II:
Prototype
Hardware
Software

Desired Deliverables Description:

Phase I would be to identify the system requirements, physical infrastructure including interfaces, data architecture and sources, security and data assurance measures needed for the system, and public and private partners.

Phase II would be to build the planned system and market it to several localities.

State of the Art and Critical Gaps:

Some systems exist e.g., Los Angeles has a scooter tracking system and app for their Department of Transportation and many localities have apps for their metros e.g. Washington DCs, Metro app. This would be a comprehensive multimodal system.

Relevance / Science Traceability:

This subtopic is relevant to the Aeronautics Research Mission Directorate (ARMD) AAM Mission and the eight projects supporting that mission. Proposers seeking funding for aircraft design and individual aircraft operations should submit to vehicle technology subtopic in A1 and proposers seeking airspace design and operations funding should submit to the A3 topic.

References:

1. NASA’s National Aeronautics Committee briefings: https://www.nasa.gov/aeroresearch/aero-nac-committee
5. ASTM WK731142 https://www.astm.org/DATABASE.CART/WORKITEMS/WK73142.htm
6. FAA UAM ConOps 1.0 https://nari.arc.nasa.gov/sites/default/files/attachments/UAM_ConOps_v1.0.pdf