Unmanned Aerial System (UAS) Traffic Management (UTM) Collaborative Testing Special Notice

NASA Ames Research Center (ARC), is hereby requesting information through this notice from interested parties for the following: NASA's Concepts and Technology Development Project seeks to identify U.S.-based public, private, and academic organizations to collaborate with NASA to conduct Unmanned Aerial System (UAS) and UAS Traffic Management (UTM) research and development with the collective goal of safely enabling these operations at lower altitudes by UTM system. The collaboration will involve a series of UTM builds with evolving complexity. This notice also solicits interested parties' questions, comments, suggestions, clarifications, and any data that would help the agency prepare for such collaboration. There will be no funds exchanged between NASA and collaborating parties.

Potential collaborators who may consider responding include:

- UAS manufacturers,
- Personal aircraft vehicle manufacturers,
- UAS avionics and middleware industry representatives,
- UAS operators: Cargo Delivery, Precision Agriculture, and others
- UAS start up and mature companies,
- Software companies supporting UAS operations,
- Sensor manufacturers,
- Communication/navigation/surveillance providers,
- System integrators,
- Federal Aviation Administration (FAA) UAS test sites,
- Universities, academicians, researchers,
- Satellite communication, surveillance, tracking systems industry,
- System integrators,
- UAS Mission planning software systems,
- Ground station system developers, and
- Others who have capabilities to enable low altitude airspace operations.

The final product of these tests will result in a working prototype UTM system and documentation of results that demonstrate how the low-altitude airspace and UAS operations could be safely enabled for the entire stakeholder community and national benefit.

BACKGROUND

The goals of the NASA Aeronautics Research Mission Directorate (ARMD) include enabling low-altitude airspace and UAS operations. Stakeholders at the UTM workshop held in February 2014 discussed the need for airspace management system automation, procedures, rules, and regulations to safely enable low-altitude airspace and UAS operations. NASA's research and development activity, UTM, addresses this critical gap.

For the purposes of this document, UTM is focused on low-altitude (AGL 2000 feet and below) in Class G airspace.

ARMD's Airspace Operations and Systems Program plans to conduct simulations and field tests of increasingly sophisticated UTM builds to enable diverse vehicles, operations, and scenarios/missions at these altitudes. This research will require collaborating with many entities such as manufacturers; operators that include retailors, search and rescue, firefighting, science, academia, etc.; communication, navigation, and surveillance system designers, airspace system developers, system integrators, FAA, National Oceanic and Atmospheric Administration (NOAA), FAA test sites, etc.

BENEFITS

The product of these field tests will be beneficial to all collaborating parties, NASA researchers, the FAA, the NOAA and National Weather Service (NWS), academia, UAS manufacturers and applications industry, avionics industry, and policy makers.

Collaborating parties receive valuable performance data about their assets and ability to operate in the mixed airspace.

NASA will test the algorithms and UTM capabilities to safely enable low altitude operations and operational requirements for wind/weather integration, airspace design/geo-fencing, sense-and-avoid/separation management, demand/capacity imbalance management, contingency management, and enabling requirements such as communications, navigation, and surveillance.

Policy makers receive data to support the understanding of procedures, safety processes, and options for safe management of the low altitude airspace.

UTM BUILD EVOLUTION APPROACH

The UTM builds will begin with baseline functionality and then evolve. Below are a series of anticipated nominal builds, where the functionality and scope will be adjusted as needed to accommodate stakeholder interests.

UTM Build 1: Goal is to show information that will affect the UAS trajectories

1. Geo-fencing and airspace design
2. Methods for establishing and maintaining UTM airspace (e.g. Open and close airspace decision based on the weather/wind forecast)
3. Separation/collision avoidance procedures and techniques for UAS within UTM airspace
4. Basic scheduling of vehicle trajectories
5. Terrain/man-made objects database to verify obstruction-free initial trajectory

UTM Build 2: Goal is to make dynamic adjustments and contingency management

1. All functionality from Build 1
2. Dynamically adjust availability of airspace
3. Demand/capacity imbalance prediction and adjustments to scheduling of UAS where the expected demand is very high
4. Management of contingencies – lost link, inconsistent link, vehicle failure

UTM Build 3: Goal is to manage separation/collision by vehicle and/or ground-based capabilities

1. All functionality from Build 2
2. Active monitoring of the trajectory conformance inside geo-fenced area and any dynamic adjustments
3. UTM web interface, which could be accessible by all other operators (e.g., helicopter, general aviation, etc.)
4. Management of separation of heterogeneous mix (e.g., prediction and management of conflicts based on predetermined separation standard)

UTM Build 4: Goal is to manage large-scale contingencies

1. All functionality of Build 3
2. Management of large-scale contingencies such as "all-land" scenario

Table 1 (attached) shows the anticipated field tests and demonstration spirals. Multiple or repeated runs of the same build could be tested over multiple days to accommodate interest and diversity of vehicles and operations.

ASSUMPTIONS

Interested parties can assume the following:

1. NASA will lead the development of the test schedule and test matrix. NASA's goal is to conduct tests that are diverse in nature, both in terms of vehicle capabilities and applications. NASA will coordinate with the FAA for information and technology assessments.
2. The more the credible number of collaborators, the richer and more representative the tests, data, and results will be. Therefore, NASA has not a-priori set a limit on the number of collaborators.
3. All vehicles will have to go through the NASA Airworthiness process and/or demonstrate proof of process and airworthiness review conducted by the vehicle manufacturer or operator.
4. NASA will bear the costs involved in logistics of the conducting tests, data collection, analysis, and report generation as well as UTM build development. However, NASA will not be acquiring or paying for the UAS, collaborating party's personnel involved in preparation of the tests, and activities associated with collaboration.
5. NASA's Office of Chief Counsel will require each collaborating party to sign a Release Form. Generally, the Release Form will require collaborating parties to waive all claims against the U.S. Government and to indemnify the U.S.

Government against third-party claims, for all NASA-sponsored activities during the UTM collaboration. The Release Form will also address the release of UTM test data to collaboration parties and the protection of collaborating parties' proprietary data.

6. Collaborating parties will be required to provide proof of insurance having reasonable coverage amounts set by NASA. Also, collaborating parties will assume liability for any damage and injuries caused by their personnel or equipment.
7. Depending on the business use/missions/scenarios, some vehicles and associated missions may not be used in these collaborative tests.
8. Tests will be conducted at locations that are legally acceptable for the UTM testing.
9. Based on the test conditions and vehicle/scenario mix, NASA (and support contractors) will request Certificate of Authorization (COA) to conduct these tests.
10. NASA will develop UTM builds that will be incorporated in the field-testing. Further, NASA may use live, virtual, constructive environment to increase the complexity of the test conditions and scenarios.
11. NASA (or NASA-appointed contractors) will collect data and results related to UTM, which will be shared with all stakeholders that are involved in the study. Common data regarding overall results of the test will be shared with the FAA and all participants in the test. Vehicle or proprietary capability-specific data (e.g., accuracy of flying trajectories) will be provided only to the collaborating party responsible for that vehicle or capability.
12. NASA will be the arbiter for balancing the needs of various stakeholders.
13. As needed, further tests involving the models of cities or urban areas will be created and tested.

RESPONSES

Interested parties are requested to respond to this notice with an information package. The information packages are due no later than September 24, 2014 and shall be submitted via email only to parimal.h.kopardekar@nasa.gov and bethany.a.mcclave@nasa.gov. Proprietary information, if any, should be minimized and must be clearly marked.

The information package shall be limited to two (2) pages and shall include the following, at a minimum:

--Name, mailing address, phone number, and e-mail of designated point of contact.

--Information regarding your interest in and capability to contribute to this research and dvelopment effort, including, as applicable, details about prospective unmanned aerial vehicles and mission descriptions; mission planning capabilities, communication, navigation, and surveillance capabilities including low-altitude radar, sensors, algorithms

for sense and avoid, geo-fencing, wind/weather prediction products, FAA approved test site airspace, and other parts to support UTM design or the system itself.

If a potential collaborator will provide UAS towards testing, its information package must clearly state its interest (e.g., vehicles, applications, mission and/or trajectory planning systems; weather/wind prediction models, 3D terrain data base, geo-fencing software and/or data base, decision support capabilities, communication, navigation, and surveillance system, hardware and software, sense and avoid technologies, etc). The vehicle manufacturers or operators (e.g., cargo delivery, monitoring key surveillance assets, search and rescue, entertainment, etc.) should provide details such as the stage length of vehicles without refueling/recharging, size and weight of the vehicle, type of vehicle (e.g., multi-copter or fixed wing), contingency management approach/technology (e.g., lost link, energy depletion), sense and avoid capability, and other characteristics of vehicle and operations including termination ability. Communications and redundancies in communications with vehicles must be described.

If a potential collaborator is likely to provide a low-altitude radar or any other communication, navigation, and surveillance equipment that requires an external power source, its information package must clearly identify how much power is required and how they will provide the power source if an electrical connection is not available at the site.

--Questions, comments, suggestions, clarifications, and any data that would help the agency prepare for such a collaboration.

NASA may contact you to gather additional information to ensure clarity after the initial response. Once the responses are collected and depending on the test conditions and locations, collaborators will be scheduled to participate in the tests of one or multiple builds.

Attachments:

1. Unmanned Aerial System Traffic Management (UTM) NASA’s factsheet
2. Aviation Week article on UTM
3. Table 1: UTM Field Test and Demonstration Spirals (Notional Schedule)