

Agility Prime Area of Interest Three (AOI #3)

Air Race to Certification 3: Cargo ORBs

Introduction and Description (adapted from Innovative Capabilities Opening--ICO)

This AOI is governed by the Agility Prime ICO (or Opening) and will help the Government assess the transformative vertical flight market and Vertical Takeoff and Landing (VTOL) technologies. This effort seeks to establish a collaborative strategy with industry and investors that accelerates fielding of the most promising technologies for savings and utility to the Government, as well as potential commercial market success. As these systems mature toward certified commercial operations, the Government will identify opportunities for early adoption, with the potential for procurement and fielding in the next three years.

The core technologies of interest include emerging electric VTOL (eVTOL) and Urban/Advanced Air Mobility (UAM/AAM) aircraft, although alternatives will be considered. These aircraft may incorporate non-traditional electric or hybrid propulsion for manned or optionally manned missions, with onboard pilot, remote pilot, or autonomous control. Based on emerging commercial trends, these transformational commercial vehicles are typically characterized by employment of distributed propulsion for vertical flight and potential use of a wing for horizontal flight, along with augmented flight control systems, and high levels of automation or autonomy. Besides aircraft, this effort will consider similar support to enabling technologies.

During this Opening, the Government intends to test the hypothesis that, compared to other ground and air vehicles, these aircraft could revolutionize mobility given: 1) lower maintenance cost and time, through mechanical simplicity; 2) improved safety and declining personnel demands, using autonomy; 3) affordable quantity, based on potential mass production; 4) improved acoustics, employing distributed propulsion; and 5) greater flexibility and reduced infrastructure needs, with runway independence. To mitigate risk, this hypothesis will initially be tested outside of the urban environment in scenarios that could potentially open a broad public-use market for early Government adoption prior to civil certification in a way that accelerates UAM. Modularity similar to a satellite bus or universal serial bus (USB) could enable vast use cases. These vehicles, referred to as ORBs, are not drones, cars, helicopters, trucks, airplanes, motorcycles, or SUVs, but might support similar missions. Given their flexibility, an ORB could act as an *organic resupply bus* for disaster relief teams, an *operational readiness bus* for improved aircraft availability, and an *open requirements bus* for a growing diversity of missions. ORBs could enable distributed logistics, sustainment, and maneuver, with particular utility in medical evacuation, firefighting, civil and military disaster relief, installation and border security, search and rescue, and humanitarian operations.

This effort expands on what has thus far been a fruitful but ad hoc engagement with industry in this sector through the following path: 1) requesting details regarding planned commercial technologies and markets; 2) identifying technologies that are likely to result in successful prototypes; 3) creating opportunities for collaborative test planning with the potential of offering test assets and expertise; 4) leveraging this campaign for near-term government airworthiness

authorization as well as procurement of hardware, software, data, or services. The intent is to accelerate certification, while also assessing the value of early adoption and fielding. Near-term government use-cases could occur prior to civil certification and might provide revenue and data to help accelerate even broader adoption and technology development.

AOI Details

The Government, in collaboration with industry, seeks to develop a strategy to assess the above hypothesis using the submitter's specified technology. The objective of this AOI is to produce a prototype test report. This AOI provides the steps to that objective, which begins with a Solution Briefing from the submitter. For the purposes of this AOI, a prototype test report is the final document resulting from an aircraft test campaign. As outlined in the Initial Capabilities Offering (ICO), Section 6 - *Successful Completion* and Section 7 - *Follow-on Production*, the prototype under this AOI will be deemed successful when the objectives for the below specifications set forth in this announcement are met in its entirety listed under the paragraph entitled *AOI#3 Information*. For this specific AOI, a successful prototype test report is one that accurately assesses the vehicle and shows that the vehicle can achieve an airworthiness authorization and eventual certification, as well as demonstrate value through cost and utility data for potential early government adoption.

Following the delivery of this prototype, the Government may choose to purchase hardware, software, data, or services. While this AOI is open until 17 December 2020, early submitters with mature technologies will have priority scheduling for potential government resources. While the Government continues to investigate a broader set of technologies for future industry engagement, the focus here is on vehicles with significant commercial market potential and planned performance and safety to meet the following:

Specifications:

Cargo aircraft, not necessarily designed to carry occupants

MTOGW: Greater than 1,320 lb

Payload: Greater than 500 lb

Range: Greater than 200 miles

Speed: Greater than 100 mph

Endurance: Greater than 100 minutes

First Full-Scale Flight: Prior to 17 December 2020

This call is not intended for companies seeking early or developmental funding. However, those companies, as well as other companies not meeting the above criteria, are encouraged to help shape the Government strategy in this sector by providing inputs to the "Request for Information (RFI) on Vertical Take-off and Landing (VTOL) Capabilities and Associated Technology" posted at beta.SAM.gov: (<https://beta.sam.gov/opp/2d5302c37bb4459ca81216bd7cf51787/view>).

It is not the Government's intent to acquire data rights to existing technology as a part of this AOI. This AOI may allow for foreign participation. Please refer to ICO Section 8 for statutory requirements.

Proposal Guidance

1. This AOI will remain open until noon EST on 17 December 2020, although Solutions Briefs will be evaluated as they are received. Submitters who are not selected will be notified in accordance with the ICO.
2. Refer to the Agility Prime Innovative Capabilities Opening (ICO), FA8625-20-R-2028, posted at <https://beta.sam.gov> for submission instructions, requirements, and guidelines for Solution Brief submittal in response to this AOI. Specific to this AOI, include the following:
 - a. Slides or a document with items identified in the “AOI #3 Information” section below.
 - b. Completed MS Excel data file (use attached format).
 - c. Amplifying information or caveats to the MS Excel data file (slides or document).
3. Solution Briefs shall be submitted to the Agility Prime ICO organizational mailbox: ATTN: Mary DelRaso; flyorbs@afwerx.af.mil.
4. Submission subject lines shall read “(Insert Company Name) Agility Prime ICO AOI #3 Submission.” Submissions received after the specified due date and time, or submitted through any other channels besides the established Organizational Mail Box, will not be accepted.

AOI #3 Information

A. Overview

1. Overview Information: Provide summary aircraft description, intended primary use, modes of operation, dimensions, three-view drawing, system masses (maximum gross weight, empty weight, battery/fuel weight, useful load, payload, other details), payload-range under defined operating conditions/mission profile; avionics systems; flight control scheme; use of software containers and Kubernetes. Describe what technology or approach differentiates this platform from others.
2. Accomplishments: Provide the following timelines — actuals, else planned (year and month):
 - 1st/10th/100th full-scale flight
 - First vertical takeoff and landing
 - First transition flight (cruise mode, not simply hover transition)
 - Planned civil certification date
 - Number of hours/flights flown (to date and planned by 17 December 2020)
 - Number of flying full scale aircraft (to date and planned by 17 December 2020)
 - On a scale of 1-10, self-assess employment of digital engineering (0=slide rule and 10=full digital twins for all aircraft through design, manufacturing, test, operations, and maintenance--please describe in the submission)

B. Technical Specifications and Performance

1. Specifications: Please complete and submit the data requested in the attached MS Excel file
2. Acoustics: Describe expected acoustic signature, primary sources of noise, acoustic management and planned testing approach
3. Limits: Describe operational envelope, robustness and any limitations with respect to temperature, pressure, environmental factors, winds/gusts and vibration in a flight environment; define any other operational constraints

C. Operational Relevance

1. Market: Describe plans to transition/commercialize and the types of variants anticipated; include information on engagements and ideas socialized with potential customers, potential to capture sales in foreign markets; include any feedback (commitments, partnerships, anticipated agreements, etc.)
2. Operations: Discuss servicing and logistics needs, infrastructure, and hanger requirements; provide estimates for Operations and Support costs per flight hour and maintenance and spares requirements; describe a typical concept of operations and operational tempo (flight hours per week)
3. Safety / Cargo Assurance: Describe your approach to addressing aircraft and cargo safety. Describe key hazards, probability of occurrence and mitigation approaches. Describe protection of the air vehicle, occupants (if applicable) and cargo as well as persons and infrastructure on the ground.
4. Traffic Management: Explain testing for integration into the air traffic system

D. Testing Approach

1. Ground Test: Describe ground testing conducted and the use of simulations, including pilot-in-the-loop, hardware-in-the-loop, and software-in-the-loop testing; discuss how test data will be used to improve simulations and to reduce flight test risk
2. Test Program: Provide timeline and locations of flight tests that have been conducted and those planned along with representative images; provide a description of the flight approval processes; indicate approximate flight test cost (e.g., cost per flight hour); discuss operational tempo; list special test equipment requirements, communications, ground stations, etc. What type of in-kind support would be most beneficial to your efforts (range time, test support, operational user input, airworthiness review, etc.)? Discuss approach to human factors testing and include details of already approved requirements of 32 CFR 219.103, or what approvals are needed to pursue by the Air Force. Describe ground control station and remote piloting requirements and approaches, airspace, general test envelope, etc.
3. Government Testing: Describe options on the possibility and timing for the government to procure aircraft/services for experimentation; describe the type of arrangement that would be beneficial to accelerate time to market and approximate cost to the government and/or the potential for in-kind exchanges; address your willingness to engage with DoD airworthiness processes to obtain limited flight releases for potential early use case flights
4. Ranges: Indicate test range preferences along with alternatives and whether testing will be conducted at an existing location or at a new (different) facility; indicate preference of test site — FAA, NASA, Department of Defense site, type of airspace, etc.; is there a desire or willingness to use a third-party contractor range; discuss number of aircraft involved in flight testing and aircraft transport requirements
5. Data: Describe data to be acquired and lay out data delivery milestones that align with the program execution plan. Discuss data-reduction methods to evaluate test results (e.g., to assess operational requirements and procedures, maintenance, reliability, cost, performance, and technical data)

E. Vehicle Development and Certification

1. **Funding:** Describe key investment financials and investors
2. **Development and Production:** Provide number of full-scale aircraft built, variants and descriptions, number of aircraft planned to be completed over the next 24-36 months; timeline of the objectives and risk reduction plans for development and continued operations, including key future milestones in support of airworthiness and FAA certification; note key flight milestones and production schedules along with near, mid, and long-term technology insertions and capabilities; describe targeted maturity by the end of 2023
3. **Certification:** Describe flight release/approval processes — clearances and authorities to date and for proposed phases; describe current and planned engagement with the FAA for civil certification; describe current or planned engagement with NASA; describe current and planned civil/military certification criteria, sources (e.g. 14 CFR Part 23, MIL-HDBK-516c, etc.), artifacts (e.g. analyses, models, flight test, etc.), and waivers; describe key risks and mitigations
4. **Supply Chain:** Describe “off-the-shelf” design, sub-systems, components and use, special requirements and challenges in sourcing as well as certification compliance