Air-to-Air Refueling Mechanism (A2RM) Digital Design Challenge #tacticaltanking #PlatformAgnosticPetrol #BoomBuddyTanking #AutonomousAerialRefueling

BLUF

The United States Air Force (USAF) seeks in-flight, platform agnostic fuel transfer hardware technology that can provide fuel to both receptacle and probe equipped receivers. The USAF is interested in any and all capabilities that can achieve the desired outcome of enabling Department of Defense (DoD) and joint coalition aircraft the ability to transfer fuel from legacy and future aircraft to legacy and future tactical aircraft. Initial scoping for design considerations should focus on a preliminary use for the F-15.

OVERVIEW

The USAF aims to leverage recent technological advancements in automated aerial refueling to modernize fuel transfer systems for smaller, more flexible refueling capabilities. These new systems will enable the USAF to perform tactical refueling missions akin to the United States Navy's (USN) buddy tanking, enable automated aerial refueling capabilities, and provide flexibility for mission planners & joint strike packages, to name a few. This AFWERX Challenge seeks an in-flight, extendible, modular, and stowable air refueling apparatus that is capable of a boom/receptacle refueling (at a minimum), with a desire for dual boom/receptacle and probe/drogue refueling. The subsystem is intended to remain as platform agnostic as possible.The capability is primarily intended to refuel medium to small "fighter" sized aircraft.

The USAF looks to acquire digital designs for feasibility and cost studies and/or experimentation, as well as developed solutions. In either case, the USAF is interested in understanding all underlying designs and technologies upon which the solution relies; to include fuel transfer mechanism hardware, relative navigation sensors, and autonomy.

OBJECTIVES

There are two objectives of the **Air-to-Air Refueling Mechanism Design Challenge**:

1. The **first objective** of this AFWERX Challenge is to digitally design a new fuel transfer mechanism up to a conceptual design review (CoDR), at minimum, that is compact, modular and affordable for a significantly broader

range of platforms at an acceptable tolerance to performance and safety relative to design intent.

2. The **second objective** is to expand the list of potential vendors and solution providers of aerial refueling subsystems.

CONTEXT

The USAF is interested in new solutions and enhancements to existing solutions and/or the development of multi-capable solutions. For this Challenge, the USAF has identified a set of desired capabilities known as attributes. Please note that these are not requirements, but are offered simply to clarify USAF needs. Additionally, the list of desirable capabilities provided here should not be considered comprehensive.

Attributes include, but are not limited to:

- Highly platform agnostic
    - “Podded” and internally stowable
        - Entire system needs to stow within system Outer Mold Line (OML)
    - System is no larger than 36” diameter & 230” in length (fits notionally in a 600 gal external fuel tank)
        - Objective is to fit in even smaller profile of ~330 gal external fuel tank (more universally used across USAF & USN)
    - Capability can expect minimal power, hydraulics, etc. from host aircraft.
        - Define what the minimum power, hydraulics, fuel, etc would be needed to enable the concept
        - Interested in solutions that stow their own fuel, solutions that receive fuel from host aircraft, and especially interested in capabilities that can do both
    - Compatible with fielded refueling technology (relative navigation sensors, pumps/valves, automation, station keeping systems, etc)
        - Leverage technology that can be matured & integratable NLT FY26
- Compatible at minimum with Universal Aerial Refueling Receptacle Slipway Installation (UARRSI) equipped receivers
    - Desire for system to also accommodate probe equipped receivers (without ground modifications)
- Fuel transfer mechanism approximately 20-30 ft in length while maintaining safe separation of receiver aircraft
    - Desire for as long as possible to better accommodate a variety of

potential aerodynamic effects
    - System still must comply with ATP 3.3.4.5
- Aero mechanically controllable fuel transfer mechanism end effector(s) (as applicable)
- From 200-400 gallons of JP-8 per minute fuel offload rate
    - Desire for capability to vary fuel flow
- System closely complies with the following standards & policy guidelines for aerial refueling where relevant:
    - ATP 3.3.4.5
    - ATP 3.3.4.6
    - Mil-F-38363
    - MMPDS (HDBK5 replacement)
- Compatible with JP-8, JP-4, JP-5, Jet-A, & Jet-B fuel types

Based on internal knowledge and market research conducted with industry and academia, the USAF has assembled an initial set of focus areas to bring structure to the crowdsourcing process for this AFWERX Challenge. Focus areas include, but are not limited to, the following list of attributes.

FOCUS AREAS

1) Innovative Boom / Receptacle & Probe / Drogue Technologies:
The USAF is primarily interested in highly developed scaled boom technology that may be ready for development/fielding on an accelerated timeline.

Simultaneously, the USAF is interested in better understanding novel fuel transfer mechanisms that are compatible with legacy refueling receiver configurations (UARRSI & probes).

- Capabilities
    - Controllable end effector (specifically for boom)
    - Stowable and extendable fuel transfer mechanism within the volume of the pod
    - Can react to deviations of a receiver within the refueling envelope
    - Reliable (relative to price point)
        - Submissions should consider reliability/reusability/robustness relative to system cost
    - Leverages relevant unique material/manufacturing capabilities to optimize performance/reduce cost of overall system
        - System must still be compliant with MMPDS (HDBK5 replacement)
    - Only Class A modifications to receivers (Paint, stickers, etc)

- Capable in relevant traditional refueling envelopes

2) Fuel Transfer Mechanism Controllability

This system has a critical function to maintain controllability over its end fuel effector (as applicable) during all stages of operation. Additionally, the system is capable of taking initiation inputs & executing accordingly.

- Capabilities
  - Capable of receiving commands from a controlling agent
    - Provides feedback on successful execution
  - System design supports current concept of operations (CONOPS)
  - Capable of execution of emergency procedures accordingly
  - Capable of controlled, predictable, and stable movement of the end effector (as applicable)

3) Platform-Agnostic Interfaces

System will remain as platform agnostic as possible.

- Capabilities
  - Value placed on not imparting major modification requirements to the host aircraft to be operational
  - Take instruction for movement, fuel offload, & emergency procedures from an external controlling agent
  - The system will be built with modularity in mind – for easy upgrading of pumps, sensors, etc in mind
  - Describe necessary internal power, pressure, coolant to remain “capable” for a variety of host aircraft

4) Smart Sensors & Integrations

The system will adequately assess all necessary functions, includingrelative navigation related sensing.

- Capabilities
  - Understands and communicates system health to controlling agent
  - Understands fuel flow rates/pressures
    - Addresses abnormal pressures
  - Understands and communicates its own position relative to the host aircraft
  - Understands and communicates receiver position from rendezvous to contact.
  - Maintains station keeping capabilities to coordinate contact w/ receiver
  - Cyber & EW resiliency

Additional Areas of Interest
Based on the submission, speak to the automation and user interface implications relative to the design. Additionally, define the Digital Engineering approach.

WHO SHOULD PARTICIPATE

The USAF welcomes involvement from individuals or teams in industry, academia, investing, and government. We encourage working with partners or teams to meet or exceed the evaluation criteria.

What do you stand to gain?

- Potential to receive funding for concept development and/or rapid prototyping and prospective further development of your solution within the USAF
- Potential long-term contract or agreement and continuing business relationships with the USAF and other government agencies
- Chance to inform and shape our nation's elite warfighting capability, positively impacting our Airmen and creating a more resilient and mission-ready military force
- Opportunity for teaming and technology development
- Potential invitation to attend the Challenge showcase event and network with peers, the USAF and DoD, customers, and other investors
- Official recognition for you and your organization, if selected, through publication on internal and external USAF communication channels

PROCEDURES

The submission and evaluation process evolves over three spirals.

1. **Spiral 1 Solution Submissions**: Offerors submit the web form and optional supplemental document. The Government will evaluate solution submissions against the criteria within this Call. Selected offerors will be invited to Spiral 2.

2. **Spiral 2 Oral Demonstration**: Selected offerors will be invited to provide additional information to elaborate on and discuss their proposed concept/technology/solution. The Government will evaluate oral demonstrations against the criteria within this Call. Selected offerors will be invited to submit proposals in Spiral 3.

3. **Spiral 3 Request for Commercial Solution Opening (CSP)**: Offerors whose solution submission and oral demonstration are evaluated and determined to hold sufficient technical merit will be invited to submit a full written proposal. Instructions and evaluation criteria will be provided in the Spiral 3 Request for Commercial Solution Proposal.

SUBMISSION OF SOLUTION FOR SPIRAL 1

Participation in this challenge requires a completed submission using the afwerxchallenge.com website: https://afwerxchallenge.com/air-to-airrefueling/air-to-air-refueling-mechanism-a2rm-digital-design-challenge/overview. The submission period opens on 24 October 2023 and ends on 15 December 2023 at 4:59 PM Pacific Time.

1. The Form includes the below fields:
    a. **Solution title**: Provide the concise name of your solution.
    b. **Executive summary**: Explain your solution in 500 characters or less.
    c. **Solution description**: Explain in detail how your proposed solution or potential new capabilities fulfill requirements, close capability gaps, or provide potential technological advancements in support of the Challenge mission. Describe the unique aspects of your technology and the proposed work as it relates to the applicable Challenge mission focus area, including key attributes such as data sources, automation, user experience, cyber security, and ability to integrate with other systems.
    d. **Value proposition**: Describe how your solution can benefit the USAF. Provide an assessment of how the solution brings value to the warfighter.
    e. **Inputs and outputs**: List the inputs and outputs that your solution needs and produces (if applicable) so an integration effort can more easily be defined.
    f. **Solution maturity**: Indicate the development stage of your proposed solution, e.g., idea, prototype/experiment, complete application (has been tested and is ready for launch), or commercially available. Identify whether the effort includes the pilot or demonstration of existing commercial technology (identified as commercially ready and viable technology), or the further development of commercial technology for potential defense application.
    g. **Scalability**: Identify the ability of the solution to scale rapidly across USAF and other agencies, and whether the proposed solution can provide a reasonable management approach for technical delivery and schedule.
    h. **Proof of concept**: Can you provide a test or proof of concept (PoC) for your solution, prior to potential implementation at scale? If yes, provide the timeline required to complete the test or PoC.
    i. **Implementation**: Provide the timeline required to implement your solution, including potential lead time for parts order/shipment.
    j. **Digital Engineering**: Digital Engineering and Acquisition will be a primary pillar for this initiative. Please outline your digital engineering strategy.

k. **Keywords**: Specify any descriptive keywords that may be useful for a search related to your solution.
l. **Offeror Information**: Provide point of contact name, email address, phone, and address.
m. **Attachment**: Attachments are supplemental data. Supplementary documents shall not exceed five (5) single-sided written pages using 12-point font.

Note:

- Public submissions can be edited until the submission deadline.
- Participants can attach private files that are only made visible to the evaluation team.
- If submission fields are left black, the submission will not be considered.
- Extensions will not be granted.

EVALUATION CRITERIA FOR SPIRAL 1:

A designated team of Government and Government contracted personnel will evaluate Challenge submissions to determine which solutions should advance to Spiral 2. The Government will use the following evaluation criteria, giving each item equal importance:

- **Relevance:** demonstrates alignment with the Challenge purpose and focus areas
- **Timeliness:** prepared and able to leverage technologies that will be integration ideally ready by end of FY25 to provide a high quality solution in as short a window as possible
- **Technical merit:** product/technology works as stated in support of mission objectives and demonstrates feasibility
- **Innovation:** demonstrates a novel, unique, or previously underutilized approach when considered against the Government application
- **Integration potential:** manufacturability, functionality, and maintainability as part of a system
- **Scalability:** meets or exceeds the needs of mission profiles for broad impact across the USAF
- **Impact:** expected benefits to the USAF and Airmen

ORAL DEMONSTRATION CONTENT FOR SPIRAL 2:

Offerors invited to participate in Spiral 2 shall address the following:

a. Expanded details of the potential solution that was provided in the Spiral 1

solution submission.

b. A live demonstration of the potential solution utilizing relevant and/or analogous data.
c. Should the solution require assistance with testing, validation, and/or capacity for scaling within the USAF, identification of the magnitude, type, and scale of assistance required for follow-on activities.
d. Rough order of magnitude (i.e., bottom-line estimated price) of the solution provided in Spiral 1.
e. The solution submission will identify all intellectual property (IP) in the technology, all owners and licensors thereof, and associated restrictions on the Government's use of that IP.
f. The oral brief should be able to address detailed Q&A from DoD stakeholders, including both technical and operational subject matter experts.
g. The purpose of the showcase is to provide networking opportunities with Government/non-Government communities interested in solutions. Information presented will only impact evaluations if content at the showcase is not consistent with content of solution submissions and oral demonstrations.

Note:

- Each offeror will be allowed a specified amount of time for their oral demonstration. This will include time for Q&A.

EVALUATION CRITERIA FOR SPIRAL 2:

Oral presentation evaluation criteria is listed below, with each item of equal importance.

a. Responsiveness of the solution in addressing the Challenge mission focus areas.
b. The technical merit of the proposed solution adequately addresses the Challenge mission focus area and demonstrates feasibility for the Government to pursue the proposed solution.
c. The Rough Order of Magnitude will be considered for affordability determinations only.

Note:

- Spiral 2 demonstrations may be recorded for Government evaluation purposes.
- Offerors that fail to upload their video within the prescribed timeline or miss their allotted time slot for an oral demonstration may be disqualified from participation in the Challenge.

COMMERCIAL SOLUTION PROPOSAL (CSP) CONTENT AND EVALUATION FOR SPIRAL 3:

Offerors invited to participate in Spiral 3 will be provided a CSP, which will detail instructions to offerors and explain the basis for evaluation.

WHAT'S NEXT

The submission period opens on 24 October 2023 and ends on 15 December 2023 at 4:59 PM Pacific Time.

- Submissions shall be made at afwerxchallenge.com, and all required fields must be completed in order to be accepted.
- Communication to all successful and unsuccessful Challenge participants will be sent via email.
- The showcase will take place as an online or in-person event. Offerors selected to participate will receive notification via email. Another evaluation will be completed at the showcase via private pitches and public discussions with evaluators on the virtual showcase website.
- All dates are subject to change. We'll communicate any changes via sam.gov and afwerxchallenge.com.

GOVERNMENT CONTRACTING TERMS & CONDITIONS

Future contracting opportunities related to the A2RM Digital Design Challenge will be posted to any/all Government points of entry such as sam.gov, sbir.gov, afwerxchallenge.com, etc.

- This Call falls under Commercial Solutions Opening (CSO) FA2280-23-S-C001. A copy of the CSO can be obtained by searching for the FA2280-23-S-C001 at sam.gov. This Call and subsequent awards shall comply with all requirements of the CSO.
- In the event of a conflict between information contained on afwerxchallenge.com and the USAF solicitation on sam.gov, the CSO on sam.gov shall control.
- The announcement of AFWERX events, considered to possess high potential for further efforts, may be made at afwerxchallenge.com. FAR-based contracting instruments, Other Transaction (OT) for Prototype Projects 10 USC 4022, to include follow-on production OTs, and Prize Competitions 15 USC 4025 may support the accomplishment of these events.
- All announcements made at both sam.gov (formerly fbo.gov) and afwerxchallenge.com website(s) are considered to satisfy the reasonable effort to obtain competition per 15 USC 3719 (e) and 10 USC 4022 (b)(2).
- Possibilities exist to work with existing prime contractors on USAF contracts through submissions provided in response to this Challenge.
- All FAR-based actions will follow post-award synopsis procedures per FAR subpart 5.3 accordingly.
- Subject Matter Experts advising the Government team may include firms contracted by other participating DoD branches (U.S. Army, U.S. Marine Corps, U.S. Navy, and U.S. Coast Guard). These firms are contracted to provide advisory and assistance services to the USAF or other DoD branches. These

firms are an important supporting element in ongoing efforts; however, they may be asked to provide limited advice on potential solutions. It is the responsibility of participating firms to protect their intellectual property or other proprietary information as necessary.

- Notice to Offeror(s): The Government reserves the right to cancel this open Call, either before or after the closing date. If the Government cancels this open Call, the Government has no obligation to reimburse an offeror for any costs.
- The submission deadline is noted in the section labeled “What’s Next.” The submission deadline is controlled by the AFWERX Challenge server time and is not dictated by local participant computer time. AFWERX Challenge shall not be held responsible for discrepancies in computer times, delays due to internet connectivity, server performance due to large numbers of participants utilizing the software simultaneously, or other factors outside of AFWERX Challenge’s control. No exceptions will be made for late submissions regardless of the reason. It is advisable to complete submissions well in advance of the submission deadline.
- This Call may result in the award of prototype projects, which include not only commercially available technologies fueled by commercial or strategic investment, but also concept demonstrations, pilots, and agile development activities that can incrementally improve commercial technologies, existing Government-owned capabilities, and/or concepts for broad defense and/or public application(s). The Government reserves the right to award a FAR Part 12 procurement contract or an Other Transaction (OT) under 10 USC 4022 agreement, including prototype and follow-on production, or no contract instrument at all, as a result of this Call. Consistent with 10 USC 4022, awards of follow-on production contracts must be made through the use of competitive procedures unless the award of an initial OT provides for a follow-on production contract and the OT participant successfully completed the prototype project.
- In accordance with Section 5.8 of the CSO, non-Government advisors may participate as non-scoring members during evaluations. For this Call, non-Government advisors include Collaboration.Ai LLC and theDifference.
- Foreign-owned businesses may independently submit a solution or do so as part of a teaming arrangement with one or more U.S.-owned businesses. Foreign participation is subject to small business and domestic sourcing restrictions and incentives in this CSO, or as may be imposed in the future by the President pursuant to the Defense Production Act, 50 U.S.C. 50 U.S.C. 4501, et. seq., or the Department of the Air Force. The ability of foreign-owned businesses to obtain a contract award or OTA based upon a submission may depend upon the ability of the foreign-owned business to obtain necessary clearances and approvals to obtain proscribed information, and the ability to comply with U.S. laws, regulations, and contractual terms.

Agency-level protests submitted under Spiral 1 or Spiral 2 shall be submitted to Sandi Brubaker, Contracting Officer, at sandi.brubaker@afwerx.af.mil. Agency-level protests submitted under Spiral 3 shall be submitted to the Contracting Officer executing the award.