**DEPARTMENT OF THE AIR FORCE**
HEADQUARTERS AIR FORCE LIFE CYCLE MANAGEMENT CENTER
WRIGHT-PATTERSON AIR FORCE BASE OHIO

**BULLETIN**
**AWB–320A**
31 July 2018

**United States Air Force (USAF) Airworthiness Bulletin (AWB)-320A**

**Subject:** Aerial Refueling

**Attachments:** (1) Glossary of References and Supporting Information
(2) Aerial Refueling Airworthiness Impact Checklist

1. **Purpose:** Provide instructions for obtaining the proper Airworthiness (AW) approvals for Aerial Refueling (AR) flight test, demonstration, and operations. The process described in this bulletin ensures the physical and functional interface compatibility between a tanker/receiver pair are evaluated so that AR events involving USAF air systems can be accomplished safely.

2. **Office of Primary Responsibility:** For questions on this bulletin, contact the USAF Airworthiness Office, USAF.Airworthiness.Office@us.af.mil. For questions regarding implementation of this bulletin, contact the Aerial Refueling Certification Agency (ARCA), USAF.ARCA@us.af.mil.

3. **Applicability:** This bulletin applies whenever a USAF air system is intended to conduct AR flight test, demonstration, or operations as either a new or modified tanker or receiver, or as an air system that will couple with a new or modified tanker or receiver.

4. **Definitions:**

4.1. **ARCA:** The organization, manned by AR subject matter experts within AFLCMC/EZFA, tasked with executing technical AR certification/clearance activities for USAF air systems.

4.2. **AR Clearance-to-Test Letter (AR CTL):** A letter issued by ARCA which assesses the compatibility of a specific tanker/receiver pair and confirms AW assessments are complete for each involved USAF air system. The AR CTL includes technical and Operational Safety, Suitability and Effectiveness factors and determines if the planned test/demonstration effort will yield the data required for program objectives. The AR CTL documents any limitations for test, lists applicable Military Flight Releases (MFRs) and test plans, and details any required safety related build-up.

4.3. **AR Flight Test/Demonstration:** Any flight activity that places a receiver within 300 feet aft of a tanker and flying in the general wake of the tanker for the purposes of AR system evaluation. The flight activity does not necessarily have to involve actual tanker/receiver contacts and/or actual fuel transfer from the tanker to the receiver.

4.4. **AR Technical Evaluation (AR TE):** An engineering evaluation generated by ARCA of a particular tanker/receiver pair when the USAF has responsibility for at least one of the participating air systems. It serves as the technical foundation for AR aspects of an AW compliance assessment.

4.5. **AR Technical Compatibility Assessment (AR TCA):** A letter issued by ARCA providing an engineering analysis of the ability of a tanker/receiver pair to safely mate, transfer fuel, and subsequently decouple, in fulfillment of United States Transportation Command (USTRANSCOM) processes and the United States Standards Related Document for North Atlantic Treaty Organization Standardization Agreement 3971 (Allied Tactical Publication 3.3.4.2). The AR TCA includes technical and operational suitability factors for a particular tanker/receiver pair, summarizes test results, lists applicable AW approvals, provides recommended operating limitations and instructions, and identifies risks.

4.6. **International/Sister Service/Commercial (ISSC) Tanker/Receiver:** A tanker or receiver platform that is owned and/or operated by an international defense agency, a Department of Defense sister service, or a commercial entity.

5. **Background:**

5.1. ARCA was created to provide a centralized resource for AR technical expertise to implement and execute AR certification/clearance activities for USAF air systems. ARCA conducts AR assessments, resulting in AR TEs to support AR CTLs and AR TCAs. An AR Delegated Technical Authority (DTA), within ARCA, has been granted delegated authority to make limited AW determinations on behalf of Chief Engineer (CE)-Level DTAs.

5.2. During an AR event, the design and/or capabilities of the tanker or receiver can affect the AW of the other. There is always an AW impact consideration for AR; therefore, the AW of the tanker/receiver pair must be assessed from a system perspective prior to conduct of AR flight tests, demonstrations, or operations.

5.3. In order to participate in AR flight tests or demonstrations, an AW approval for each involved USAF air system and an AR CTL are required.

5.4. Prior to AR operations, an AW approval is required for each involved USAF air system and an AR TCA is required by USTRANSCOM to verify that the involved tanker/receiver pair is technically capable of safely conducting AR.

5.5. This bulletin ensures that both the AW of individual aircraft (via AW approvals) and the AW of the coupled tanker/receiver pair (via an AR CTL or an AR TCA) are assessed prior to AR events involving USAF air systems.

**6. Process:** CE-Level DTAs shall follow the normal AW process to support issuance of flight test and operational AW approvals. To obtain AR CTLs or AR TCAs the following additional steps are required:

**6.1. Determining AW Impact:**

6.1.1. As there is always an AW impact when an air system is seeking a first-time AR pairing, the originating program CE-Level DTA shall provide ARCA with a list of intended coupling air systems.

6.1.2. For air system modifications, the CE-Level DTA shall determine if the modification impacts AR related AW criteria (MIL-HDBK-516C, Airworthiness Certification Criteria, paragraph 8.7) and/or potentially impacts the AW of any coupling air system (Attachment 2).

6.1.2.1. The CE-Level DTA shall document their determination on their Airworthiness Determination Form (ADF).

6.1.2.2. If there is an impact to either their air system or a coupling air system, the CE-Level DTA shall obtain ARCA coordination on the ADF.

6.1.2.3. If there is no impact, no further AR related work is required.

6.1.3. For introduction of, or modifications to, ISSC air systems, ARCA is the USAF focal point and shall assess AW impacts to any coupling USAF air system.

**6.2. Coupling Air System Impact:**

6.2.1. ARCA shall notify the CE-Level DTAs of all impacted coupling air systems and provide a system description of the originating program.

6.2.2. CE-Level DTAs of impacted coupling air systems shall complete an ADF to determine reportability and the AW plan in light of the originating program's new or changed capabilities.

**6.3. AR Flight Test/Demonstration Clearance:** If AR flight test/demonstration is required:

6.3.1. CE-Level DTAs of impacted coupling air systems shall provide appropriate data to ARCA to support the AR TE.

6.3.2. CE-Level DTAs of impacted coupling air systems shall obtain an ARCA-issued AR TE to support an AW assessment.

6.3.3. CE-Level DTAs of impacted coupling air systems shall issue or obtain an MFR that permits AR flight test/demonstration with the particular coupling air systems. The MFR will address the recommendations identified in the ARCA-issued AR TE and shall detail any limitations, instrumentation, configurations, or instructions for conduct of AR flight test or demonstration.

6.3.4. CE-Level DTAs of impacted coupling air systems shall provide to ARCA the MFR that will allow their air system to participate in AR flight tests/demonstrations.

6.3.5. ARCA shall issue the AR CTL and provide to the CE-Level DTAs of impacted coupling air systems and to the appropriate flight test organization(s).

**6.4. Operational Clearance:**

6.4.1. CE-Level DTAs of impacted coupling air systems shall provide appropriate data to ARCA to support the AR TE.

6.4.2. CE-Level DTAs of impacted coupling air systems shall obtain an ARCA-issued AR TE (updated if flight test/demonstration was required).

6.4.3. CE-Level DTAs of impacted coupling air systems shall issue or obtain AW approvals that permit AR operations. The AW approvals will address recommendations identified in the ARCA-issued AR TE, and shall detail any specific limitations, instrumentation, configurations, or instructions specific to the conduct of AR operations.

6.4.4. CE-Level DTAs of impacted coupling air systems shall provide an operational AW approval to ARCA.

6.4.5. ARCA shall issue the AR TCA to USTRANSCOM and provide a copy to the CE-Level DTAs of impacted coupling air systems.

6.4.6. CE-Level DTAs shall notify ARCA whenever an AW approval, which supported the issuance of the AR TCA, expires or is superseded by a subsequent AW approval which impacts continued AR operations between the specific tanker/receiver pair.

**7. Other Considerations:**

7.1. When a new, modified or coupling air system is an ISSC, ARCA serves as the interface to USAF air systems. ARCA is responsible for soliciting AR flight test/demonstration requirements from the AW authorities of ISSC coupling air systems and notifying CE-Level DTAs of coupling impact. CE-Level DTAs must follow applicable portions of this process.

7.2. CE-Level DTAs of impacted coupling air systems shall follow the normal risk assessment and acceptance process prior to issuance of a flight test/demonstration or operational AW approval.

7.3. It is highly encouraged for CE-Level DTAs of air systems with AR capability to engage ARCA at each step in the process to seek technical guidance. ARCA can assist in identifying first-time AR pairings, establishing AR technical requirements, assessing potential AR impacts, identifying verification methods, assessing risks, and documenting operational limits for affected air systems.

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## Attachment 1

## GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

***References***
MIL-HDBK-516C, *Airworthiness Certification Criteria,* 12 Dec 2014

***Abbreviations and Acronyms***
**ADF** – Airworthiness Determination Form
**AR** – Aerial Refueling
**AR CTL** – Aerial Refueling Clearance-to-Test Letter
**AR TCA** – Aerial Refueling Technical Compatibility Assessment
**AR TE** – Aerial Refueling Technical Evaluation
**ARCA** – Aerial Refueling Certification Agency
**AW** – Airworthiness
**AWB** – Airworthiness Bulletin
**CE** – Chief Engineer
**DTA** – Delegated Technical Authority
**ISSC** – International/Sister Service/Commercial
**MFR** – Military Flight Release
**MTC** – Military Type Certificate
**TAA** – Technical Airworthiness Authority
**USAF** – United States Air Force
**USTRANSCOM** – United States Transportation Command

***Terms***
**AW Approval** – Document issued by the Technical Airworthiness Authority (TAA) or DTA which affirms that the appropriate tenets of the AW process are met and that the air system was assessed against the required airworthiness standards and any residual risk to aircrew, ground crew, passengers, or to third parties has been accepted by the appropriate authority. For AR events, an AW approval is either an MFR or Military Type Certificate (MTC).

**MFR** – An AW approval for an air system design that does not meet the full standards and/or intent of an MTC.

**MTC** – An AW approval based on evidence that the air system type design is substantially in compliance with its approved certification basis (typically only LOW and MEDIUM risks remain due to non-compliances).

**Attachment 2**

**AERIAL REFUELING AIRWORTHINESS IMPACT CHECKLIST**

1. **Tanker:** The following is a non-exhaustive list of factors which the Chief Engineer-Level Delegated Technical Authority (CE-Level DTA) for a USAF tanker must consider as possibly impacting the airworthiness of the coupling receiver air system:

1.1. Change in/impact to visual cues used by receiver(s) during AR process:

1.1.1. Change in exterior tanker lights used during AR process:

1.1.1.1. Change in light type (e.g., incandescent versus LED).

1.1.1.2. Change in levels of illumination.

1.1.1.3. Change in area/dispersion of illumination.

1.1.1.4. Change in color.

1.1.1.5. Change in light logic/symbology (e.g., change in AR system Status Lights).

1.1.2. Change in tanker outer mold line used by receiver(s) during AR process:

1.1.3. Change in exterior marking design and/or material.

1.1.4. Change in tanker paint scheme (e.g., military gray to European camouflage).

1.1.5. Relocation/removal/addition of items on underside of tanker's fuselage/wing used by the receiver for formation reference (e.g., antennas, doors, pods, blisters).

1.2. Change in tanker AR system design/performance:

1.2.1. Change in AR system's fuel delivery rate or pressure to the receiver:

1.2.1.1. Change in tanker AR pumps/pumping system.

1.2.1.2. Change in tanker's pressure regulation and/or surge suppression system.

1.2.2. Change in approved fuel(s) which could be off-loaded to receiver(s).

1.2.3. Change in properties of delivered fuel (e.g., temperature, electrical conductivity).

1.2.4. Change in boom system design/performance:

1.2.4.1. Change in Boom Control System:

1.2.4.1.1. Change in boom extension/compression breakout forces.

1.2.4.1.2. Change in boom structural load capability.

1.2.4.1.3. Change in boom outer mold line.

1.2.4.1.4. Change in boom mass.

1.2.4.2. Changes that affect tanker's ability to communicate via boom intercom system.

1.2.5. Change in subsystems interfacing with AR system:

1.2.5.1. Hydraulic system:

1.2.5.1.1. Change in power supplied to tanker AR system.

1.2.5.1.2. Change in hydraulic fluid.

1.2.5.2. Change in electrical power supplied to tanker AR system.

1.2.6. Change in drogue system design/performance:

1.2.6.1. Change from non-interchangeable to interchangeable AR wing pods or vice versa (i.e., left wing station to/from right wing station).

1.2.6.2. Change in pod type/vendor/series number.

1.2.6.3. Change in wing pod station on the tanker's wing.

1.2.6.4. Change in drogue/canopy design (e.g., drag, diameter).

1.2.6.5. Change in coupling/hose (e.g., type, vendor, latch setting [with and without fuel pressure]).

1.2.6.6. Change in hose/marking colors.

1.2.6.7. Change in hose marking pattern.

1.2.6.8. Change in hose length at full trail position:

1.2.6.8.1. Change in hose system's fuel transfer positions and/or inner limit for hose response capability.

1.2.6.8.2. Change in hose reel response system design/performance (e.g., hydraulic versus fueldraulic versus electrical powered; mechanical versus microprocessor control).

1.2.6.8.3. Addition/Removal/Repositioning of any chines, channels, strakes or any other devices affecting airflow of the drogue system.

1.3. Change in tanker's flight performance:

1.3.1. Change in propulsion system(s):

1.3.1.1. Change in engine thrust capability.

1.3.1.2. Change in engine vendors.

1.3.1.3. Addition of an in-flight operable auxiliary power unit (if able to be used during AR operations).

1.3.2. Change in tanker's flight control system:

1.3.2.1. Change in Operational Flight Program.

1.3.2.2. Change in design (e.g., analog vs digital control, fly-by-wire vs mechanical).

1.3.2.3. Change in design/performance Autopilot or Stability Augmentation System.

1.3.3. Change in tanker's angle of attack during AR operations within AR envelope:

1.3.3.1. Change in tanker gross weight/center-of-gravity.

1.3.3.2. Change lift device deployment schedules during AR (flaps/slats)

1.3.4. Change causing an update to the tanker's applicable TO 1C-##-1-1.

1.4. Change in Boom Operator/AR operator viewing system (direct view versus remote):

1.4.1. Change in field of view during AR operations.

1.4.2. Change in depth perception/clarity/resolution.

1.4.3. Change in viewing system latency.

1.4.4. Change in image displays/overlays:

1.4.4.1.Change in cameras.

1.4.4.2.Change in image processing software/hardware.

1.5. Changes to/addition of other air system systems activated during AR operations:

1.5.1. Defensive countermeasure systems.

1.5.2. Communication Navigation Surveillance/radios.

1.5.3. Identification Friend-or-Foe/Selective Identification Feature.

1.5.4. Data links.

1.5.5. Flight test instrumentation.

1.5.6. Fuel drain and jettison system(s).

1.6. Changes affecting induced environment that the receiver(s) experiences:

1.6.1. Loads.

1.6.2. Electromagnetic Environmental Effects.

1.6.2.1. Changes to electromagnetic environment created by tanker during AR.

1.6.2.2. Changes to the induced electrostatic charging environment created by the tanker/receiver pair during AR operations.

1.6.3. Fluid exposures.

1.7. Non-configurational (operational centric) changes:

1.7.1. Change in AR procedures.

1.7.2. Change in AR envelope (airspeed/altitude) for tanker AR system.

1.7.3. Change in environmental conditions during AR operations.

1.8. Changes impacting the dimensional clearance between the tanker (to include tanker's AR system/interface) and the receiver (to include the receiver's AR system/interface).

1.9. Changes that require SEEK EAGLE certification/re-certification:

1.9.1. Store configurations that exceed approved drag indexes during AR.

1.9.2. Store configurations that exceed approved asymmetric loads during AR.

2. **Receiver:** The following is a non-exhaustive list of factors which the Chief Engineer-Level Delegated Technical Authority (CE-Level DTA) for a USAF receiver must consider as possibly impacting the airworthiness of the coupling tanker air system:

2.1. Change in outer mold line of receiver.

2.2. Changes that impact visual cues used by the tanker AR Operator during AR process:

2.2.1. Changes to exterior lights used during AR operations.

2.2.2. Changes to crew station lights illuminated during AR operations.

2.2.3. Change in exterior paint scheme.

2.2.4. Change in outer mold line of receiver.

2.2.5. Change in color/design of AR Bay lead-in markings for the boom.

2.3. Change in airflow in/around receiver AR interface such that the stability/control of the tanker and/or its AR interface could be impacted.

2.3.1 Change in outer mold line of receiver.

2.3.2 Introduction of an outflow vent in the vicinity of the AR interface

2.4. Change in receiver AR system design/performance:

2.4.1. Changes in receiver AR/fuel system that could impact refuel rates and/or the level of surge pressures generated during fuel transfer from a tanker.

2.4.2. Changes in acceptable properties of delivered fuel (e.g., temperature, electrical conductivity).

2.4.3. Changes in hydraulic system to receiver AR system:

2.4.3.1. Operating pressure.

2.4.3.2. Fluid type.

2.4.4. Changes in electrical power to receiver AR system.

2.4.5. Changes affecting receiver's ability to communicate via boom intercom system.

2.4.6. Change in receiver interface (probe or receptacle) vendors.

2.5. Changes in receiver aircrew viewing capability of tanker cues:

2.5.1. Canopy/windscreen properties.

2.5.2. Aircrew eye position during AR.

2.5.3. Heads-Up Display layout.

2.5.4. Helmet mounted display (e.g., Joint Helmet Mounted Cueing System) layout.

2.6. Changes impacting the dimensional clearance between the tanker (to include tanker's AR system/interface) and the receiver (to include the receiver's AR system/interface):

2.6.1. Relocation of the receiver's AR interface.

2.6.2. Change in receiver preferred fuel transfer position once engaged (probe/drogue operations).

2.6.3. Addition of other components in/around the receiver's AR interface.

2.6.4. Changes that impact the path of the tanker AR interface to the receiver AR interface that is required to achieve a contact and/or following disconnect.

2.7. Change in receiver's flight performance:

2.7.1. Change in propulsion system(s):

2.7.1.1. Change in engine thrust capability.

2.7.1.2. Change in engine vendors.

2.7.2. Change in receiver's flight control system:

2.7.2.1. Change in Operational Flight Program.

2.7.2.2. Change in design (e.g., analog vs digital control, fly-by-wire vs mechanical).

2.7.3. Change in receiver's angle of attack during AR operations within AR envelope.

2.7.4. Receiver gross weight/center-of-gravity beyond previously approved.

2.7.5. New external stores configuration (drag count, asymmetric drag) beyond previously approved.

2.7.6. Change in receiver's flight control/handling qualities.

2.7.7. Change in outer mold line of receiver.

2.7.8. Change causing an update to the receiver's applicable TO 1#-##-1-1.

2.8. Changes affecting induced environment that the tanker experiences:

2.8.1. Electromagnetic Environmental Effects during AR operations:

2.8.1.1. Changes to electromagnetic Radio Frequency environment created by receiver.

2.8.1.2. Changes to the induced electrostatic charging environment created by the tanker/receiver pair.

2.8.2. Changes in receiver's bow wave characteristics (e.g., distance from tanker at onset, magnitude).

2.9. Changes that impact the loads experienced during AR operations:

2.9.1. Increase in receiver closure rates (probe/drogue operations).

2.9.2. Change in boom load alleviation system

2.9.3. Change in probe mast stiffness properties.

2.10. Changes that require SEEK EAGLE certification/re-certification:

2.10.1. Store configurations that exceed approved drag indexes during AR.

2.10.2. Store configurations that exceed approved asymmetric loads during AR.

2.11. Changes to/Addition of other air system systems activated during the AR operations:

2.11.1. Defensive countermeasure systems.

2.11.2. Communication Navigation Surveillance/radios.

2.11.3. Identification Friend-or-Foe/Selective Identification Feature.

2.11.4. Data links.

2.11.5. Flight test instrumentation.

2.12. Non-configurational (operational centric) changes:

2.12.1. Changes to AR procedures:

2.12.1.1. Change in desired AR envelope (airspeed/altitude).

2.12.1.2. Change in environmental conditions during AR operations.

2.12.1.3. Overt/Covert (use of/change in aided visual systems during AR process).

2.12.1.4. Different range of needed receiver closure rates in probe-drogue.

2.12.1.5. Change in AR operations (e.g., simultaneous receiver refueling, receiver cell formations, special operations, etc.).

2.12.1.6. Different receiver positioning needed once engaged in probe-drogue AR operations.

2.12.1.7. Towing capability required (receptacle systems).

2.12.2. Changes which impact receiver crew workload during AR operations (e.g., change in aircrew compliment and/or change is assigned aircrew duties).