ARSAG

AERIAL REFUELING SYSTEMS ADVISORY GROUP

Guidance document

Aerial Refueling Tanker and Receiver Similarity Criteria

Document Number 66-21-23
Date 06 June 2023

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14. ABSTRACT
This document provides guidance on the criteria for a Tanker/Receiver Similarity Statement that attempts to identify relevant similarities with, and differences to, a previously cleared receiver aircraft with a given, paired tanker. The criteria should identify any significant differences that need to be addressed by further examination and evaluation. Any restrictions/cautions identified from the Technical Compatibility Assessment (TCA) used, need to be examined for applicability to the similarity aircraft. This process enables the production of a new TCA to enable a Read-Across aerial refueling clearance.

15. SUBJECT TERMS
AR=Aerial Refueling

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RECORD OF REVISIONS

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Following initiatives to standardize the processes and procedures for Aerial Refueling Clearances, this document provides guidance on the criteria for a Tanker/Receiver Similarity Statement (TSS/RSS) that attempts to identify relevant similarities with, and differences to, a previously cleared receiver aircraft with a given, paired, tanker. The criteria should identify any significant differences that need to be addressed by further examination and evaluation. Any restrictions/cautions identified from the Technical Compatibility Assessment (TCA) used, need to be examined for applicability to the similarity aircraft. This process enables the production of a new TCA to enable a Read-across AR clearance.

Though the core of the criteria is founded in the technical aspects related to the design definition of the aircraft, it is also essential to define and identify the framework where the similarity statement is going to be developed (approvals, organizations involved, roles and responsibilities, technical requirements, recognitions), which is the basis for the whole Read-across process definition. Relevant concepts associated to the Read-across are also included within this document to clarify the context.

PROJECT INITIATION FORM (PIF)

Items 1 through 3 to be Completed by Requester

1. PROJECT SPONSOR OR INITIATING AGENCY

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2. PROJECT REQUEST

Project Purpose and Scope	This document is for a Tanker/Receiver Similarity Statement (TSS/RSS) that attempts to identify relevant similarities in support of a Read-across in pursuit of a technical compatibility assessment. "A GUIDE TO OBTAINING AIR-TO-AIR REFUELING CLEARANCES AND COMPATIBILITY ASSESSMENTS" NATO SRD ATP-3.3.4.2.1. This SRD establishes the means for conducting Aerial Refueling Technical Compatibility Assessment (TCA), including read across based on similarity to allow using acceptable data collected previously or by third parties. This Similarity PIF will provide the criteria for making the Similarity Claim for the read across in accordance with the Certification Specifications in ANNEX C of the SRD. (see page 2 "Need for Project" for Scope)
Proposed Project Title:	Aerial Refueling Tanker and Receiver Similarity Criteria

Proposed Product Outcome: (Mark with X)

ARSAG Document:	**Guide Document**		**Recommended Requirements**		
	X				
Input to DoD Standardization Document:	**Specification**	**Standard**	**JSSG**	**Other**	
		X			
Input to NATO Document:	**ATP/ STANAG**	**STANREC**	**SRD**	**Allied Publications**	
	X		X		
Input to Industry Document:	**Standard**		**Other**		

Would you be willing to participate as Document Manager for your proposed project?	**Yes**	**Sara Fernandez**	**No**	

3. PROJECT TIMELINE

Project Request Submittal Date:	**Date**	**15 Sept 2021**
Requested Completion Date:	**Date**	**30 Dec 2022**

Item 4 to be Completed by ARSAG

4. PROJECT DISPOSITION

Project Request Receipt Date		15 Nov 2021	
		JSB Chair	**JSB Deputy Chair**
Approved as ARSAG Project: Initial & Date		FHC, 23 Nov 2021	DAB, 19 Jan 2022
Declined as ARSAG Project: Initial & Date			
		ARSAG Executive Director (ED)	
Approved as ARSAG Project: Initial & Date		DHK, 16 November 2021	
Declined as ARSAG Project: Initial & Date			
Priority Assessment	2	**Project Number Assignment:**	66-21-21
Working Group Assignment		Grp 5; Grp Lead, R. Simms; Doc Mgr, Sara Fernandez	
If project is declined, provide rationale			
ARSAG Response to Sponsor/Initiating Agency: ED initial & Date			DHK, 23 Jan 2022
Transfer to ARSAG/JSB Working Group: ED Initial & Date			DHK 23 Jan 2022

SEE PAGE 2

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Need for Project	The aim of this connection is to provide a common framework of the “rules” used to assess the Technical Compatibility. These “rules” allow to identify the scope of the disciplines involved and subsequently the aircraft and systems configuration to look at for the comparison between the Tankers (Receivers). The “rules” will finally help to identify the impact on the initial TCA of the differences found, allowing to substantiate the delta assessment to be done in case the Similarity is partial. This project has a correlation with the stand-alone project, "AR Compatibility Assessment Checklist" ARSAG Doc. number 64-08-21WD. The Checklist includes Similarity as a verification method (under Evaluation Assessment) in the three Categories of the Checklist. The Similarity project should contain criteria for making the similarity claim for the read across technical aerial refueling pairing (Tanker/Receiver) for the Clearance Process. Aircraft maintenance and aircraft AR systems maintenance are not considered within this document.
Background	
Changes to Original Project Purpose and Scope	

2.0 ACKNOWLEDGEMENTS

This project was initiated following the successful use of similarity statements used in support of the Multinational MRTT Fleet (MMF) to obtain numerous AR TCAs based on Read-across, where similarity statements played a relevant role. Among the organizations which made those Read-across TCAs possible, special mention is given to NSPA/OCCAR/RNLAF, USAF/ARCA, NAVAIR, INTA, NETMA, MRTT operators (RAAF, RAF, FAF) and Airbus Derivatives (Airbus Defence and Space).

The author wishes to thank following specialists and experts in their fields from Airbus DS who contributed to the similarity statements mentioned above: David García, Unai Sánchez, Pablo Martínez, Ricardo de Arriba Laso, Gorka Marcos, Sofía Rey, David Piatti, Carolina Ocampo, María del Mar Sierra, Alberto Sanz, Jorge García, Francisco Asensio, David Aguiar, Carolina Ocampo, Marcos Larena, and many others.)

Group 5 would like to thank all of the Military, Industry and other Organizations representatives from across the world who have participated in the development of this ARSAG Guide Document.

Specifically, this document could not have been created without the help or support of the following individuals, as Group 5 participants:

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3.0 REFERENCES

N°	*TITLE*	*REFERENCE*	*ISSUE*	*DATE*	*SOURCE*
1.	A GUIDE TO OBTAINING AIR-TO-AIR REFUELING CLEARANCES AND COMPATIBILITY ASSESSMENTS	NATO SRD ATP-3.3.4.2.1	Ed B Version 1	MARCH 2021	NSO www.japcc.org
2.	AIRWORTHINESS BULLETIN (AWB) - 320	BULLETIN AWB-320		MARCH 2017	
3.	Aerial Refueling Boom/Receptacle Guidance Document	ARSAG 20-08-17		28 July 2017	ARSAG
4.	Aerial Refueling Probe/Drogue System Guidance Document	ARSAG 04-06-18		15 Oct 2018	ARSAG
5.	Aerial Refueling Boom Receptacle System and Interface Recommended Requirements	ARSAG 02-88-12R2		12 Sept 2019	ARSAG
6.	Aerial Refueling Pressure Definitions and Terms, Design and Verification Guidance	ARSAG 03-00-03R		12 Dec 2010	ARSAG
7.	Standardized Technical Data Survey for Aerial Refueling	ARSAG 17-81-03R		6 Sept 2016	ARSAG
8.	Aerial Refueling Lighting Study	UDRI, USAF, AFLCMC/WKE		15 Sept 2005	ARSAG

4.0 ASSOCIATED DOCUMENTS

TITLE	*REFERENCE*	*ISSUE*	*DATE*	*SOURCE*
A GUIDE TO OBTAINING AIR-TO-AIR REFUELING CLEARANCES AND COMPATIBILITY ASSESSMENTS	NATO SRD ATP-3.3.4.2.1	Ed B Version 1	MARCH 2021	NSO www.japcc.org
Aerial Refueling Clearance Process and AR Clearance Compatibility Checklist	ARSAG 43-08-14		21 Aug 2014	

5.0 ABBREVIATIONS AND TERMINOLOGY

5.0.1 Abbreviations

A/C	Aircraft
AR	Aerial Refueling
ARO	Aerial Refueling Operator
ATP	Allied Tactical Publication
BDA	Boom-to-Drogue-Adapter
EMI	Electromagnetic Interference
EMC	Electromagnetic Compatibility
FCL	Flight Control Laws
HIRF	High Intensity Radiated Field
JAPCC	Joint Air Power Competence Centre
NATO	North Atlantic Treaty Organization
NVG	Night Vision Goggles
NSO	NATO Standardization Office
PDL	Pilot Director Lights
RF	Radio Frequency
RSS	Receiver Similarity Statement
SRD	Standards Related Document
TCA	Technical Compatibility Assessment
TCR	Technical Compatibility Requirements
TSS	Tanker Similarity Statement
UARRSI	Universal Aerial Refueling Receptacle Slipway Installation

5.0.2 Terminology

Boom/Receptacle	The boom method for refueling a receptacle equipped receiver aircraft
Boom	A tanker attached housing that can manoeuvre in both the lateral and vertical axes, which encompasses a telescoping tube that an operator on the tanker can extend /retract & insert into a receptacle equipped receiver A/C for receiving tanker fuel
Receptacle	The receiver aircraft method for receiving fuel in flight from a boom-equipped tanker
UARRSI	A modular unit for converting an aircraft to one having a capability for receiving fuel from a boom equipped tanker

Probe/Drogue	The hose/drogue method for refueling a probe equipped receiver aircraft
Drogue	A component part of the tanker aerial refueling hose system that stabilizes the hose in flight and provides a funnel shape to aid insertion of the receiver aircraft probe into the tanker hose end coupling
Probe Mast	The receiver aircraft refueling structural tube for extending the probe nozzle for connection with the tanker hose drogue coupling
Probe Nozzle	The probe mast component for engaging the tanker coupling for completing the connection for fuel transfer
BDA	A kit for converting a boom-equipped tanker on the ground to a drogue-equipped tanker
Spoiler	A surface for altering the normal air flow path
Read-across	See section 8.0 for the definition of Read-across and all the specific terminology related to that process

6.0 INTRODUCTION

Read-across of acceptable data (evidence or conclusions) previously collected to verify Aerial Refueling (AR) technical compatibility between a Tanker and Receiver aircraft can reduce significantly the effort of Nations to grant new AR Clearances for different aircraft versions of the same model.

A key element to applying Read-across is the verification of the technical similarity between the Tanker and/or Receiver used as reference and the intended Tanker and/or Receiver to be covered by the new TCA.

The aim of this ARSAG Guidance Document is to provide the necessary criteria for making the similarity claim to allow the Read-across of existing data (evidence or conclusions) for the technical compatibility of AR Tanker/Receiver pairing.

The benefit of the standardization of the AR similarity criteria is to optimize the efforts to validate the Technical Compatibility for AR Clearance by maximizing the re-use of data. Ultimately this will increase the interoperability among Nations. The main goals are as follows:

- Expedite the verification of the similarity claim for the Read-across.
- Simplify the Tanker and Receiver technical data requested, by focusing on those aspects affecting AR technical compatibility.
- Facilitate the sharing of data among Nations for multiple Clearances.

It is intended that this document will be submitted through ARSAG to the North Atlantic Treaty Organization (NATO) Joint Air Power Competence Centre (JAPCC) as an ARSAG recommendation to become an Annex to ATP 3.3.4.2.1.

The criteria provided in this document are defined in the following Sections by:

- A Framework to establish the scope of the assessment: the Technical Compatibility Requirements against which the new technical compatibility is to be assessed and the roles and responsibilities involved.
- Similarity Assessment that includes the data to be compared and the analysis of the differences found.
- Outcome of the Similarity Assessment that includes the extent of the Read-across to be applied.

Key words specific to this document and related to Read-across process, are defined in section 8.0.

7.0 FRAMEWORK

The similarity claim for different aircraft versions of the same model should be supported by a Similarity Statement (TSS/RSS). This Statement should be substantiated by a technical assessment. Sections 7.1 and 7.2 provide guidance on how to perform this assessment and how to produce the Similarity Statement respectively.

The items below should be defined before any Similarity Assessment to ensure proper traceability and awareness of the expectations.

7.0.1 Scope of the Similarity Assessment

The scope of the assessment should be clearly stated by specifying the following information:

- Aircraft versions (known names) to be compared, and the refueling station or device(s) to be considered (Wing Refueling Pods, Fuselage Refueling Unit, Boom Drogue Adaptor, Boom, UARRSI). If one of these versions is used as a reference against which to compare the other versions, then it should be specified.
- The intended use of the Similarity Assessment, either for reading across evidence used in support of existing TCA or for reading across the existing TCA conclusions.
- The applicability of the Similarity Assessment, either for the Read-across from one aircraft version used as reference to another or for the interoperability of versions, e.g. the equivalence of two versions (Tanker or Receiver) to operate with the same aircraft cleared with one version to another.
- When the intended use is reading across evidences: the methodology or test type used (e.g. Ground Test, Flight Test); the organizations involved in the validation (e.g. Design Authorities, Airworthiness Authorities); the tanker/receiver pair; and the information necessary to define the configuration of the reference aircraft as at the date that the evidences were collected (e.g. specific version aircraft, tail number with relevant modifications embodied).
- When the intended use is reading across an existing TCA conclusion, the validity and date of the TCA under consideration for defining the configurations to be compared.
- Design definition of each aircraft version at the date of interest for the assessment.
- Validity of the assessment. The assessment is valid so long as the target aircraft remains equivalent or unchanged with respect to those aspects that may affect the AR operation of the aircraft itself or of the paired aircraft.
- Availability and access to the Similarity Assessment by third parties. Previous agreement on this topic will facilitate further use of the assessment, especially when the authorities approving the Read-across for the other aircraft of the pair require visibility of the assessment.

NOTE: Aircraft maintenance and aircraft AR systems maintenance are not considered within this document..

7.0.2 Technical Compatibility Requirements

A valid set of Technical Compatibility Requirements can be derived from the CS-AAR in NATO Ref.1; however, other requirements may be used if agreed with the competent authority of the TCA. The CS-AAR, provides a known set of requirements that are available to everyone.

Within the Similarity Assessment context, the selection of the TCR will be used to:

- Identify the scope of the disciplines involved and subsequently the aircraft and systems configuration to look at for the comparison between the aircraft (Tankers or Receivers).
- Assess the impact on the new TCA of any differences found, including consideration of how substantial those differences are in the case of a partial Similarity.

7.0.3 Roles and Responsibilities

When applying Read-across, many different organizations may be involved. The relevant roles and responsibilities, and the corresponding organizations taking part, should be identified at an early stage to ensure an efficient process.

Specifically, for the TSS/RSS, the following actors should be identified and involved:

- TSS/RSS approval entity, either the same of the new TCA approval authority or a recognized entity as Technical Authority, who is able to validate or endorse the content in accordance with the design definition of the aircraft.
- Recognized Design authority or delegate, as owner or organization responsible for the design of the aircraft versions (Tanker or Receiver).
- New TCA approval authorities for Tanker and Receiver as end-users of the TSS/RSS. Usually, those authorities are not the same, and may apply different TCR. Authorities' cross-recognition should be confirmed or the mechanism necessary to overcome the potential differences should be agreed.

7.1 SIMILARITY ASSESSMENT

The Similarity Assessment identifies the physical and operational differences in the design of the versions of the Tankers or Receivers considered. Furthermore, it assesses the potential impact of those differences on the compliance with the requirements used to assess the technical compatibility of a pair from the Tanker or Receiver point of view respectively. This assessment will determine the Read-across possibilities.

The following paragraphs detail the steps used to perform this assessment and the information necessary to be taken into account.

7.1.1 Identification of the physical differences between aircraft

The physical differences between aircraft shall be based on the specific certified design of each aircraft for the elements listed below.

These elements are essential to determine aircraft aerial refueling capabilities and the interaction with another aircraft while aerial refueling. This list provides comprehensive guidance; however, technical authorities may also wish to review the checklist provided in AWB-320 (Ref. 2). The list should consider those particularities that may arise from non-standard or novel designs. Detailed information on AR Systems design standards can be found in the ARSAG Published Documents (Refs. 3 to 8).

The elements are considered in three main areas as follows:

1. Basic Platform configuration.

   The elements assessed under the Basic Platform configuration determine the maximum capabilities, at aircraft level, in terms of AR Flight Envelope, aircraft Handling/Flying Qualities & Performance, Weight & Balance, and the nominal Communication capability with which to perform an AR operation.

   In addition, for a Receiver, the assessment should include those elements affected by flying behind a Tanker (including in its wake and engine efflux), those elements affecting the effect of the receiver bow wave on the Tanker or on the AR device, and those elements potentially interfering in the airspace volume around the contact interface with the Tanker.

   1.1. At aircraft level.

      1.1.1. Engines. The differences should be assessed in terms of performance limits, control input and engine response for AR:

      - Tanker ceiling at a given weight (maximum altitude, maximum speed) for AR.
      - Receiver limitations, (maximum/minimum altitude, maximum/minimum speed), at a given weight, in the wake of a Tanker for AR.
      - Thrust control, either manual or automatic during AR.
      - Dynamic response as Tanker or Receiver.

1.1.2. Flight Controls. The differences should be assessed in terms of flight envelope limits, control input and control response for AR:

- Automatic flight envelope protections or features during AR.
- Flight Control Laws (FCL) during AR (normal or dedicated FCL as Tanker or Receiver).
- Manual input or automatic (autopilot modes) for AR.

1.1.3. Weight and Balance. The differences should be assessed in terms of weight/center of gravity limits during AR:

- Maximum Tanker or Receiver weight during AR.
- Limitations of Weight/CG during AR.
- Most forward/aft/lateral CG position during AR.

1.1.4. Geometrical clearance between Tanker and Receiver pair. Combination of the above elements may modify the relative pitch angle between the pair, which should be taken into account especially for Boom geometrical clearance with Receiver:

- Maximum and minimum pitch angles during AR

1.2. External configuration.

1.2.1. AR devices. The differences should be assessed in terms of aerodynamic effect on the aircraft itself or in the pair, performance penalties and visual cues.

- Type of device and location in the aircraft.
- External size and shape with device deployed for the Tanker.
- External shape with device open (doors), including with the refueling probe extended for the Receiver.

1.2.2. Significant protuberances or structural characteristics. The differences should be assessed in terms of shape and location, performance penalties and visual cues.

- External fairings (drainpipes, cameras, self-protection systems).
- Antennas.
- Probes.
- Windows.
- Doors.

1.2.3. External equipment and stores, whether releasable or not. The differences should be assessed in terms of aerodynamic effect on the aircraft itself or in the pair, performance penalties or dedicated FCL.

- Stores configuration.
- External tanks.
- External pods (GPS).

1.2.4. Specifically for Tankers, any difference on aerodynamic characteristics modifying the wake of the Tanker.

- Wing profile (trailing edge).
- Wing surface.

1.2.5. Specifically for Receivers:

Any differences in the external structure or system that may be affected by the wake or engine exhaust plume of the Tanker. The differences should be assessed in terms of susceptibility to loads, vibration, flutter, buffet, performance penalties and air data corruption.

- Propellers/Blades.
- Rotors.
- Engine intake.
- Rotodome.
- Air Data Sensors.
- Aircraft structure (e.g. tail fin).

Any difference to the front fuselage/nose that could modify the bow wave effect on the Tanker and/or AR equipment.

1.2.6. Specifically for Boom Receivers, any difference in external shape (windshield, canopy …) that could modify the geometrical clearance with the Boom.

1.2.7. Paint scheme. The differences should be assessed in terms of visual cues (e.g. Depth perception for Boom operation or Receiver orientation).

1.3. Basic navigation/communications between Tanker/Receiver.

1.3.1. Radios. The differences should be assessed that may affect the ability of the tanker to communicate with the receiver during AR.

1.3.2. Navigation. The differences should be assessed that may affect the ability of the tanker to rendezvous with the receiver for AR.

2. Specific AR configurations.

The elements under Specific AR configuration determine those characteristics associated with the refueling devices, their functional modes and performance at delivering or receiving fuel, their behaviour at the interface of both Tanker and Receiver aircraft, and their controls and interface with the operator.

2.1. AR Equipment and AR system design.

2.1.1. Exterior lights and markings used during the AR process for Tanker and Receiver.

- Formation Aids.
- Upper/Lower Rendezvous/Beacon Lights, Separate Switches (to avoid blinding operators).

- Over-wing lighting for Receiver aircraft aid to Tanker boom operator.
- Tanker Hose/Pod illumination systems.

2.1.2. Fuel delivery or receipt system installation for AR (AR lines, AR valves, set of pumps, manifolds and scavenge system) and design pressure and flow rates.

2.1.3. Specifically for Tanker with Hose and Drogue, encapsulated in the fuselage (Fuselage Refueling Unit), a pod (Wing Refueling Pods, Buddy Refueling) or adaptor (Boom Drogue Adaptor). The differences should be assessed in terms of the components that could modify the stability of the hose and drogue, hose-drogue catenary, hose behaviour on contact, drogue characteristics, visual aids for Receiver relative position self-awareness, geometry and loads at the interface.

- Hose characteristic (skin, markings, length).
- Hose reel response.
- Drogue characteristics (geometry, ribs, canopy, weight/drag).
- Reception Coupling (specification, compliance with standards, latch setting, disconnect force).
- Probe-coupling seal.
- AR lights (signal lights, logics and additional means, e.g. symbol lights, drogue illumination)
- Pod fairings and fins.

2.1.4. Specifically for Tanker with Boom. The differences should be assessed in terms of the components that could modify boom wake, structural characteristics, control input and response, visual cues, geometry and loads at the interface.

- Boom mast, including external shape and elements (fins, ruddevators).
- Nozzle assembly and nozzle tip.
- ARO Controls.
- Independent disconnect capability.
- AR signal system.
- Boom AR lights.
- AR PDLs (lights and logics).
- Boom envelope (contact and disconnect).

2.1.5. Specifically for Receiver with refueling Probe. The differences should be assessed in terms of the components that could modify bow wave, structural characteristics, geometry, visual cues and loads at the interface.

- Nozzle type and nozzle tip.
- Probe (location, fixed, retractile, length)
- Probe Nozzle illumination and Tanker aids illumination when not provided by the Tanker. Probe Mast lights and Receiver fuselage lights.

- Probe mast/nozzle/weak link structural loads (radial, compression, tension).

2.1.6. Specifically for Receiver with Receptacle.

- Receptacle, doors, slipway, structural reinforcement. Location, characteristics and latching/unlatching modes.
- Markings around receptacle.
- Receptacle slipway and area lighting.

2.1.7. Through-the-Boom Voice Communication for Boom/Receptacle AR method. Crew member(s) having the capability to talk through it.

2.2. AR System performance and AR Software.

2.2.1. AR System performance. The differences should be assessed in terms of maximum achievable flow rate, surge pressures, low flow states and operating pressures.

2.2.2. Hose Reel response, specifically for Tanker with Hose and Drogue, software or mechanisms controlling hose reel response, hose position, extension and retraction, additional Hose and Drogue functionalities (e.g. autodrift)

2.2.3. AR Software.

- Software controlling fuel dispense, fuel pumps management, fuel valves opening closing and fuel distribution.
- Specifically for Tanker with Boom, software controlling boom flying qualities, extension/retraction, automatic features (boom envelope protections) and additional Boom system functionalities.

2.3. AR Fuel Types. Approved fuel types that can be dispensed by Tanker or received by Receiver.

2.4. Aircrew viewing capability and AR Vision System.

2.4.1. Aircrew viewing capability from Tanker. Direct view.

- AR operator field of view during AR operation.
- Additional means (NVG, helmets)

2.4.2. Aircrew viewing capability from Tanker and Safety observers. AR Vision System. The differences should be assessed in terms of situational awareness for Tanker pilot and/or AR operator and the cues provided for Boom AR operation.

- Field of view during AR operation.
- Monitors.
- Image quality, color, resolution, latency, displays and overlays.
- Image management.
- Cameras locations and controls, movement capability (fixed, tilt) and zoom.
- Cameras technology. Spectrum visible, infrared, thermal. 3D, 2D

- Illuminators type and compatibility with NVG.

2.4.3. Aircrew viewing capability from Receiver. The differences should be assessed in terms of the view of tanker cues.

- Canopy/windscreen/helmet visor properties.
- Internal canopy reflections due to displays.
- Pilot position during AR (eye position, left, right, front, rear seats)
- Additional means (Head-Up Display and layout, Helmet mounted display and layout, NVG and type).

2.5. AR Console for Tankers. The differences should be assessed in terms of Human Machine Interface (HMI).

- Ergonomic characteristics.
- HMI layout. Controls positioning and feedback.

2.6. Minimum Crew for AR operation. The differences should be assessed in terms of task sharing for AR operation.

2.7. Other systems activated during AR operation. The elements listed below are considered optional, not intrinsically related to AR operation.

2.7.1. Defensive countermeasure systems.

2.7.2. Communication Navigation Surveillance.

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

2.7.4. Data links.

2.7.5. Flight test instrumentation.

2.7.6. Fuel drain and jettison system(s).

2.7.7. Radio altimeter, including alerts during AR phase.

3. EMI/EMC elements

The elements under EMI/EMC compatibility permit RF transmissions between Tanker and Receiver in close proximity flight and during AR (i.e. whenever the distance between them is lower than 0.5 NM).

The differences should be assessed in terms of HIRF environment for Tanker and Receiver during AR operation and identify those restrictions that need to be imposed on emitters during AR.

7.1.2 Identification of the operational differences between aircraft

The operational differences should be based on the specific AR operational limitations and procedures certified and applicable for each aircraft that could affect the interaction with another aircraft while aerial refueling.

1. AR limitations.

1.1. AR flight envelope as determined by aircraft and AR systems limitations.

1.2. AR devices / spatial envelope.

1.3. Environmental conditions (atmospheric and visibility conditions)

1.4. HIRF environment.

1.5. Type of Operations. Types of AR operations, including AR conducted during other types of mission such as Medevac, One Engine Inoperative AR and for those tanker aircraft equipped with two or more drogue systems, whether or not simultaneous AR was approved.

1.6. Minimum Crew for AR.

2. AR procedures.

2.1. Normal procedure for AR.

2.2. Abnormal procedures for AR.

2.3. Emergency procedures for AR.

7.1.3 Impact on Technical Compatibility Assessment

The impact on the new TCA of the physical and operational differences identified in the previous section should be assessed using the technical requirements agreed with the TSS/RSS approval entity.

For each of the technical requirements, there should be an assessment of whether any differences between the aircraft versions considered would modify the conclusion against that requirement, independent of the pairing aircraft type. The extent of an identified difference may impact the level of Read-across achievable, and although a partial Read-across may still be provided, this should be justified

Based on the CS-AAR in NATO Ref.1, the technical requirements should include at least the following:

- 1.1 General (including Hazard identification for the pairing)
- 1.2 Aerial Refueling Envelope
- 1.3 Geometric Compatibility
- 1.4 Loads Compatibility
- 1.5 System Compatibility
    - Visual References/Lights and Markings
    - Electromagnetic Environmental Effects
    - Fuel and Aerial Refueling Systems Compatibility
    - Communication, Navigation and Surveillance
    - Defensive Aids Compatibility
- 1.6 Handling Qualities
- 1.7 Human Factors and Flight Deck Interface/Air Refueling Operator Station Interface
- 1.8 Operating Limitations and Information

7.2 SIMILARITY STATEMENT

The outcome of the Similarity Assessment should summarize and establish to what extent a Read-across TCA can be produced. It should provide those aspects of the TCA that need to be further evaluated on either the Tanker or Receiver side in support of the new Technical Compatibility Assessment.

8.0 APPENDIX / AUXILIARY SECTION

This section provides the definition of key words specific to this document and related to Read-across process.

AIRCRAFT VERSION:

Variations of an aircraft type with respect to its general design (type/model/series/block).

The variations referred to herein correspond to different design definitions typically due to either different aircraft, updates and evolution of the same aircraft, different operator or a combination of these.

The similarity criteria provided in this guide is to be applied between the Tanker (respectively Receiver) versions of the reference pair and the new pair.

REFERENCE TANKER or RECEIVER:

Tanker or Receiver version (type/model/series/block) with valid TCA used as a baseline to compare for potential Read-across. They are represented as Tanker A or Receiver X in Figure 1.

TECHNICAL COMPATIBILITY ASSESSMENT (TCA):

The TCA shows the level of compliance to a set of Technical Compatibility Requirements (TCR) in order to demonstrate the AR compatibility of a specific pair (Tanker/Receiver) for the designated approval authority.

Ultimately it provides the Limitations, Recommendations and Operational Procedures for safe AR operation for the specific Tanker/Receiver pair. This is referred to herein as ‘TCA conclusions’.

The set of requirements and the level of compliance in terms of pass/fail criteria used for the requirements fulfillment depends on the agreements between the applicant and the TCA approval authority and is out of the scope of the Similarity Statement.

Within this document, a valid TCA is that approved by a recognized technical authority.

TECHNICAL COMPATIBILITY REQUIREMENTS (TCR):

Set of Requirements or Specifications that ensure safe and reliable AR operation of a Tanker/Receiver pair.

This set of requirements determines the disciplines and systems involved in the AR Operation affecting the interface between the pair.

READ-ACROSS:

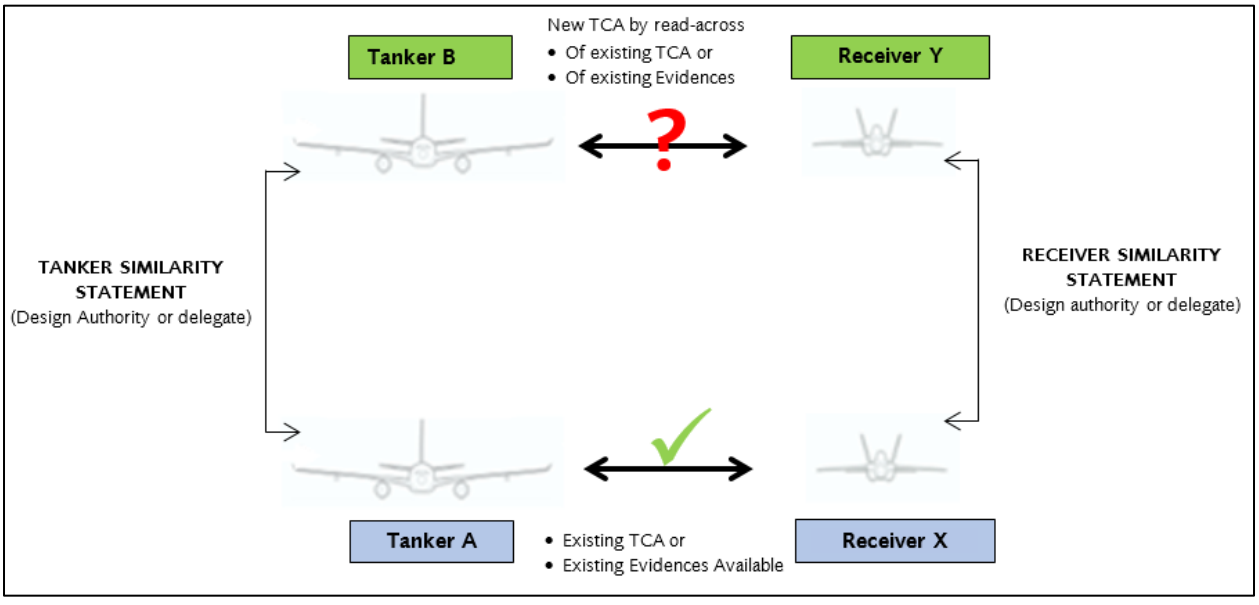
It is a methodology by which to demonstrate compliance with a requirement by re-using acceptable data (evidences or conclusions) collected from the same or other aircraft versions.

For TCA purposes, the Read-across referred to herein is the process by which a new TCA can be produced based on the TCA validated with other Tanker/Receiver versions (referred herein as reference TCA) taking into account the following:

- The re-use of acceptable data (evidences or TCA conclusions) is possible when the aircraft versions are similar in terms of AR compatibility (refer to ATP 3.3.4.2.1. Chapter 3, 3.1). This similarity is substantiated by the TSS/RSS objective of this document.
- The data collected may have been validated by a different authority using a different set of requirements or pass/fail criteria to the ones agreed with the new TCA approval authority. The assessment of the differences between the requirements used for the reference TCA and the new TCA are part of the TCA process. This is to be taken into account during the new TCA production.
- The TSS/RSS are produced to support the assessment and approval of a new pair's TCA but do not replace the TCA.
- The TSS/RSS are focused on the comparison of designs, physically and operationally (limitations and procedures), however there is a link to the technical requirements since they are used to identify disciplines and systems and the impact of the differences assessed in the Similarity Statement.
- Ideally, the requirements used for the production of the TSS/RSS should be the same or equivalent to the ones used for the new TCA production and approval. Due to the lack of standardized requirements in the past and to the different authorities involved in these processes, this may be difficult to achieve. In any case, the requirements used for the Similarity Assessment should be agreed and accepted by the approval authority of the new TCA.

The steps of the Read-across process are summarized below as shown in in figure 1:

Figure 1: Read-across philosophy



1. Reference TCA: valid existing TCA between Tanker A and Receiver X.
2. New TCA: TCA requested for Tanker B and Receiver Y.

3. TSS (respectively RSS): Substantiation of the similarity between Tankers A and B (respectively Receivers X and Y).

In summary, for the Read-across to take place, it is necessary that:

The reference TCA has to be accepted by the authority of the new TCA. The acceptance may be total or partial, for various reasons such as, but not limited to:

- Details of the reference TCA, including access to the source evidences, which may not be available for the approval authority of the new TCA (this is most relevant when there is no recognition between authorities).
- The TCR are different to those used for the new TCA.
- The means of compliance and/or pass/fail criteria are not accepted by the approval authority of the new TCA.

When the acceptance is partial, only the accepted data can be used for Read-across and a delta assessment is necessary to demonstrate compliance with the gaps identified and agreed by the approval authority of the new TCA.

EVIDENCE:

Original source data used in support of a requirement verification collected by accepted means agreed between the applicant and the authority (e.g. Definition, Analysis, Laboratory Tests, Simulation, Ground Test, Flight Test, and Equipment Qualification).

DESIGN AUTHORITY OF A TANKER or RECEIVER AIRCRAFT:

Responsible for the design of the aircraft, namely the manufacturer.

When aircraft definitions have evolved since the similarity statement was issued, or when modifications exist that are not known by the manufacturer (e.g. operators own modifications, physical or operational procedures, not shared with the aircraft manufacturer), it is the responsibility of the Operational Airworthiness Authority of the operator to communicate it to the new approval authority of the new TCA to ensure validity of the similarity statements and fill in the gap, if any.