



**ARSAG WORKSHOP /
JOINT STANDARDIZATION BOARD FOR
AERIAL REFUELING SYSTEMS (JSB)**

STATUS REPORT

APRIL 2019



ARSAG Workshops / Joint Standardization Board (JSB) for Aerial Refueling Systems

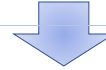
Document Procedures and Workflow

Farhad Choudhury, NAVAIR, JSB Chair

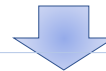


ARSAG DOCUMENT PROCEDURES and WORKFLOW

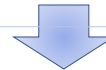
Request Submitted to ARSAG for Initiation of a Project Document Creation or Revision
Request from military or industry aerial refueling entity



Project Initiation Form
Completed by Requesting Agency



ARSAG Executive Director, JSB Chair and Deputy Chair
Accept as ARSAG Project, Prioritize, Record,
Assign to Working Group



Working Group
Working Group Lead, Co-Leads. Document Managers,
Technical Advisors, Working Group Participants
Accept as Project, Prioritize, Create or Revise Document in
Standardized ARSAG Format at ARSAG Workshop / JSB Meetings



Working Group
Submit Final Draft, ready for Document Review Team,
to Executive Director, JSB Chair, JSB Deputy Chair



**ARSAG Executive Director, JSB Chair & Deputy Chair
Review Document, Submit to Document Review Team**



**Document Review Team (DRT)
Review Document, Return with Recommendations
to Working Group and Executive Director**



**Working Group
Coordinate DRT recommended changes with Working Group
and with Executive Director's team
Working Group Leads Sign Out Document**



**ARSAG Executive Director, JSB Chair,
JSB Deputy Chair, ARSAG Secretary Sign Out Document
Executive Director Submits to NAVAIR or USAF for Publication**



**Publication of ARSAG Document
NAVAIR or AFLCMC/EZFA Clearance for Release in Public Domain
Submit for Filing on DTIC and/or ASSIST
Available for Adoption by NATO as SRD, STANAG, etc. as appropriate**



**ARSAG WORKSHOP / JSB DOCUMENTS
STATUS REPORT, APRIL 2019**

RECENTLY COMPLETED DOCUMENTS

Farhad Choudhury, NAVAIR, JSB CHAIR



ARSAG WORKSHOP / JSB DOCUMENTS
STATUS REPORT, APRIL 2019

RECENTLY COMPLETED DOCUMENTS

<i>DOCUMENT/TITLE</i>	<i>ARSAG DOC. NO.</i>	<i>DTIC NO.</i>	<i>ARSAG RECOMMENDED USE</i>
AR BOOM RECEPTACLE. SYSTEMS INTERFACE RECOMMENDED REQUIREMENT	02-88-12R1	AD1053142	ATP 3.3.4.5 (7191)
AR PRESSURE DEFINITIONS & TERMS GUIDE	03-00-03R3	AD1025801	SRD
AR PROBE/ DROGUE SYSTEMS GUIDE	04-06-18	AD1064517	SRD
MIL-PRF-57267 (MA-5 COUPLING) SPEC	13-14-15	ASSIST 57267	N/A
AR CLEARANCE INITIATION REQUEST	16-88-98R	AD1025799	SRD
STANDARDIZED TECHNICAL DATA SURVEY	17-81-03R3	AD1027954	SRD
AR BOOM/RECEPTACLE GUIDE	20-08-17	AD1048313	SRD
AR TEST METHODS GUIDE	41-09-15	AD1030015	SRD
AUTOMATED AR PROCEDURES GUIDE	42-13-17	AD1039157	SRD
AR CLEARANCE PROCESS GUIDE & COMPATIBILITY ASSESSMENT CHECKLIST	43-08-14	AD1025796	SRD
ASSESSMENT OF REFUELING HOSE VISIBILITY AFRL-RH-WP-TR2012-0145		ADB387179	N/A
AR LIGHTING STUDY UDRI/USAF	USAF AFLCMC	AD1051415	N/A



**ARSAG WORKSHOP / JSB DOCUMENTS
STATUS REPORT, APRIL 2019**

DOCUMENT STATUS REPORTS

Group Lead, Document Manager Reports

Working Groups 1, 2 and 3, Group Leads

Documents

Advanced Boom Nozzle Specification

Probe Nozzle Specification Revision

Remote Vision Guide

Formation Aids Guide

**David Benson, AFLCMC/EZFA,
JSB Deputy Chair**

**Andrew Ferguson, AFLCMC/EZFA;
Thomas Cavallaro, NAVAIR
Larry Mitchell, Omega Air**

Document Managers

Andrew Ferguson, AFLCMC/EZFA

Tom Cavallaro, NAVAIR

Sean Martin, Boeing

**Derek Ferwerda, NAVAIR
Olivia McCormick, AFLCMC/WKC**



Working Group 1
Boom / Receptacle Components and Verification Methods
Advanced Boom Nozzle Specification
ARSAG Doc # 44-15-18WD

STATUS OF DOCUMENT:

- **15% COMPLETED**

PURPOSE / BENEFITS OF DOCUMENT

- Create a universal nozzle specification that can provide an easy reference and performance requirements for any tanker program requiring interoperability with all receptacle-equipped receivers.
- Will allow for interface standardization similar to probe/drogue interface specifications.

SCOPE OF DOCUMENT

- Create a specification for a universal boom nozzle, that includes independent disconnect, and may apply to future and certain current tankers.

Andrew Ferguson
USAF AFLCMC/WKC/EZFA



Advanced Boom Nozzle Specification ARSAG Doc # 44-15-18WD

KEY ELEMENTS

1. Recently changed scope to be more useful for future tankers, which invalidated portion of earlier progress
2. Current direction may not include all elements of legacy tankers – want to include recent technological boom/nozzle interface improvements
3. Recent discussion has centered around Independent Disconnect System (IDS) loading and signal coil compatibility

**Andrew Ferguson
USAF AFLCMC/WKC/EZFA**



WORKING GROUP #2 PROBE/DROGUE COMPONENTS & VERIFICATION METHODS

PROBE NOZZLE SPECIFICATION, MIL-N-25161

ARSAG DOCUMENT NUMBER 51-16-19WD

STATUS OF DOCUMENT:

- ***80% COMPLETED***

PURPOSE / BENEFITS OF DOCUMENT

Compliance with this document ensures physical compatibility with Qualified fuel reception couplings, strength, quality of workmanship, and successful functionality throughout the life of the unit.

SCOPE OF DOCUMENT

This specification covers aerial refueling probe nozzles intended for use on receiver aircraft equipped with probe type aerial refueling systems.



Tom Cavallaro
NAVAIR, USN



KEY ELEMENTS OF DOCUMENT

- 1. Document is being rewritten in correct specification format – every requirement paragraph has a verification paragraph.**
- 2. Carefully rewritten not to apply additional requirements that fielded MA-2 nozzles can't meet.**
- 3. Electrical bonding requirement added (existing hardware is compliant).**
- 4. Continuation of Flex-tip nozzle design important for off-center disconnect events.**



WORKING GROUP #3

Formation Aids, Markings, and Lighting

Aerial Refueling Remote Vision Systems Guide

STATUS OF DOCUMENT:

- **Just Initiated**
- **Project Initiation Form Submitted and Approved**

PURPOSE:

Guide document is to facilitate an understanding of Remote Vision systems (RVS)'s for aerial refueling boom systems or aerial refueling drogue systems performed tasks

Sean P. Martin
The Boeing Company



CONTENTS OF DOCUMENT

- 1. The purpose of the Remote Vision Systems (RVS's) guide document is to facilitate an understanding of RVS's for aerial refueling boom systems or aerial refueling drogue systems.**
- 2. Increase the understanding of performed tasks in which there is a human in the loop with no direct vision of the receiver.**
- 3. Document will contain a RVS literature reviews, requirements and verification method guidance, physiological impacts and limitations.**
- 4. RVS's design considerations and lessons learned.**



Group #3
Formation Aids, Markings, and Lighting
Formation Aids Guide Document
ARSAG 06-06-19WD

STATUS OF DOCUMENT:

- **80% COMPLETED**

PURPOSE / BENEFITS OF DOCUMENT

- Design recommendations based on operators' inputs, lessons learned, proven capabilities, and past/present success/failure experiences from various platforms/studies.

SCOPE OF DOCUMENT

- Covers the wide range of design including but not limit to AR exterior lighting systems, the controls and displays at the AR Operator Station (AROS), the formation aids on the tanker, boom, drogue and hose markings as well as receptacle markings on the receivers

Olivia McCormick
AFLCMC/WKC-Dev



Path Forward

- 1. Editing Scope and document to exclude Remote Vision System (RVS)**
- 2. Additional groups are being included in the survey efforts to gather more data**
 - Waiting on data to continue work**



**ARSAG WORKSHOP / JSB DOCUMENTS
STATUS REPORT, APRIL 2019**

DOCUMENT STATUS REPORTS

Group Lead, Document Manager Reports

**David Benson, AFLCMC/EZFA,
JSB Deputy Chair**

Working Groups 4 and 5, Group Leads

**Gregory Twyford, Boeing,
Richard Simms, USTRANSCOM**

Documents

Document Managers

Aerial Refueling Incident Investigation Guide

Scott Yerxa, Boeing

Ground Support Equipment

Jim Turner, PSI

**Aerial Refueling Technical Interface
Data Acquisition**

Larry Strong, AFLCMC/EZFA

Planner Software Guide

Col Edwin Markie, JAPCC



WORKING GROUP 4 MAINTENANCE AND GROUND SUPPORT EQUIPMENT AERIAL REFUELING SYSTEMS INCIDENT INVESTIGATION GUIDE 50-17-19WD

STATUS OF DOCUMENT

- **ARSAG Document Review Team (DRT) REVIEW**

PURPOSE / BENEFITS OF DOCUMENT

- **Establish guidance for collecting receiver/tanker flight data, required for effective investigation**
- **Ties collection of incident reporting from tanker and receiver operations into single document**

SCOPE OF DOCUMENT

- **Provides instructions for initiating incident data collection, establishing agreements, and developing repositories**
- **Arranges data collection forms based on specific tanker and/or receiver configurations, and crewmember/maintenance personnel roles**

**GREG TWYFORD (on behalf of SCOTT YERXA)
THE BOEING COMPANY**



ARSAG WORKING GROUP 4

AERIAL REFUELING SYSTEMS INCIDENT INVESTIGATION GUIDE

50-17-19WD

CONTENTS OF DOCUMENT

1. General Instructions

- Starting point for affected program office or investigative agency to initiate action
- List sources for initiator to query for incident-related data (i.e. FDR, flying / maintenance records, equipment reference / clearance process guides, etc.)
- Provides instructions for which forms to use and how to document

2. Initiator's Data Collection

- List of questions for initiator to document incident-related data

3. Aircrew Data Collection

- List of questions for aircrew to provide information beyond what has already been obtained
- Sub-divided for Tanker (boom), Tanker (drogue), Receiver (receptacle) and Receiver (probe)
- Questions relative to pre-flight, incident, and post-flight activities

4. Maintenance Data Collection

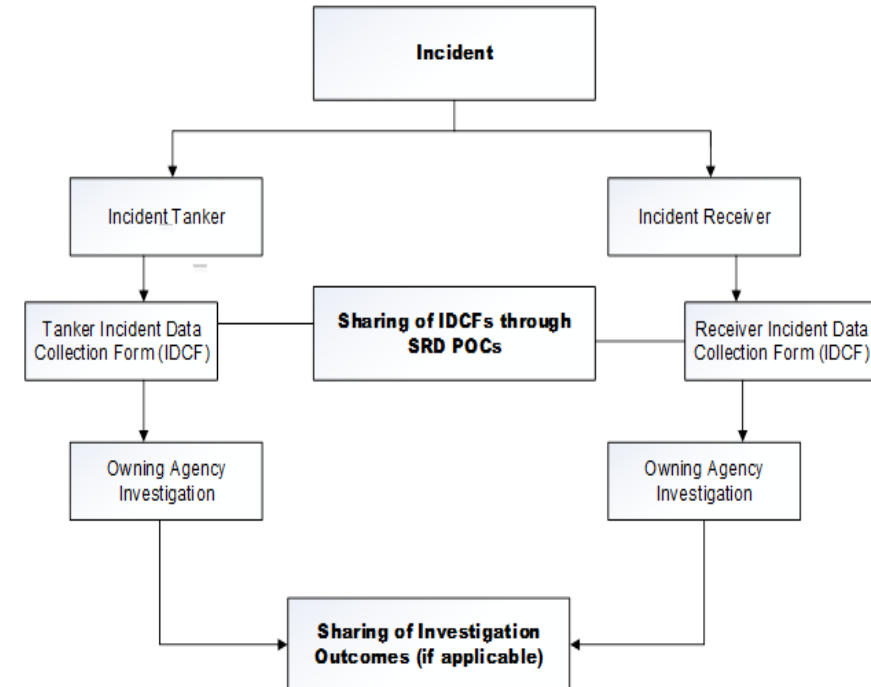
- List of questions for maintenance personnel to provide additional information
- Also sub-divided based on specific tanker and/or receiver configurations
- Questions focus on pre-flight, post-flight, and historical maintenance activities

5. Agreements

- Provides guidance on types of agreements required post event to secure successful data retrieval and analysis from both tanker and receiver program offices
- May identify where data is maintained and how to access

6. Repositories

- Provides guidance and instructions on repository proposals to access past event data for future designs, changes, or modifications





WORKING GROUP 4

MAINTENANCE AND GROUND SUPPORT EQUIPMENT

GROUND SUPPORT EQUIPMENT (GSE) for AERIAL REFUELING GUIDE

Status of document

50% Completed

Purpose / Benefits of Document

- **Provides a list of what Ground Support Equipment (GSE) is available to maintenance personnel for checking the function of aerial refueling (AR) systems**
- **Provides general knowledge of GSE to insure its proper use in maintaining the serviceability of AR systems**

Scope of document

- **Provide information on GSE available for checking/testing AR systems on both tanker and receiver aircraft, categorized by boom/receptacle and probe/drogue systems**

Jim Turner, Products Support



GROUND SUPPORT EQUIPMENT (GSE) for AERIAL REFUELING GUIDE

DOCUMENT CONTENTS

Probe and Drogue Refueling Systems

- **Tanker GSE (Coupling Test Kit; Breakaway Force Tester)**
- **Receiver GSE (Coupling Test Kit; Breakaway Force Tester)**

Boom and Receptacle Refueling Systems

- **Tanker GSE (Boom Nozzle Test Kit)**
- **Receiver GSE (Receptacle Test Kit)**

Other equipment check-out & removal tools for maintenance use



WORKING GROUP # 5
Aerial Refueling Clearance Process & Procedures
Aerial Refueling Technical Interface Data Acquisition
ARSAG Document Number: 53-18-19WD

STATUS OF DOCUMENT :

- Initiated - 10 Sept 2018
- Project Accepted - 8 Nov 2018
- Rough Draft Developed - 7 Feb 2019

PURPOSE / BENEFITS OF DOCUMENT

- Obtain essential information from contractors to support aerial refueling and airworthiness certifications of tanker and receiver airframes to aid in conducting the clearance process

SCOPE OF DOCUMENT

- Framework for releasability of information/data in the acquisition contract process

Document Manager: Larry Strong
ARCA/Sawdey Solutions Services



KEY ELEMENTS OF THE DOCUMENT

- 1. Why the information from industry is needed/required if intent is to conduct aerial refueling**
- 2. Outlines ability to shared data/reports with the intent to accelerates the AR clearance process**
- 3. Security issues such as data handling and transmitting**
- 4. Quality recognition—common trusted agencies for producing testing reports**
- 5. Standard templates on data presentation**



WORKING GROUP NUMBER 5
ARSAG Aerial Refueling Clearance Process & Procedures
Aerial Refueling Computer Planning Software Design Guide
55-18-19WD

STATUS OF DOCUMENT:

- **75% COMPLETED**

PURPOSE / BENEFITS OF DOCUMENT

- **Provide Standardization of Inputs/Outputs to Computer AAR Planning Software**

SCOPE OF DOCUMENT

- **Provides broad guidelines of the type of information AAR planners required from both the tanker & receiver to effectively/efficiently plan operations**

Col Edwin Markie
Joint Air Power Competence Centre



CONTENTS OF DOCUMENT

- 1. Provides a baseline for those looking to develop planner software**
- 2. Ensures AAR planners are working from the same list of inputs and outputs.**
- 3. Does not tell the software designer or company how to build the software or how to solve the tanker/receiver pairings**
- 4. Does not limit the types or amounts of inputs, but rather lists the minimum required information**



**ARSAG WORKSHOP / JSB DOCUMENTS
STATUS REPORT, APRIL 2019**

DOCUMENT STATUS REPORTS

Working Groups 5A and 6, Group Leads

**Steve McLaughlin, NAVAIR;
Rob Tipton, Lockheed Martin
Henry Clarke, Cobham**

Documents

**Automated Aerial Refueling Procedures
Guide Revision**

**Document Managers
Ba Nguyen, AFRL/RQQC**

**Boom/Receptacle Recommended
Requirements**

Harry Slusher, Boeing

Boom/Receptacle Guide

Harry Slusher, Boeing

Aerial Refueling Documents Reference Guide

T. J. Pitsor, AFLCMC/EZFA

**Probe/Drogue Recommended
Requirements**

**Pablo Arnal, Airbus;
Derek Ferwerda, NAVAIR**

Aerial Refueling Modeling & Simulation Guide

Elizabeth Knoblauch, NAVAIR



**ARSAG WORKING GROUP 5A
Automated Aerial Refueling
Automated Aerial Refueling CONOPS Rev1
ARSAG DOCUMENT NUMBER – 42-13-17R1**

STATUS OF DOCUMENT - 90 % Completion

PURPOSE / BENEFITS OF DOCUMENT- Make small revisions to previous published Auto Air-to-Air Refueling (A3R) CONOPS Guide

SCOPE OF DOCUMENT- The purpose of this document is to provide guidelines for the development of A3R systems to ensure the solutions are interoperable within the international community

**Ba Nguyen
Air Force Research Lab
Aerospace System Directorate**



CONTENTS OF DOCUMENT

- 1. General**
- 2. Conceptual A3R System Overview**
- 3. A3R Positions**
- 4. Navigation Requirements**
- 5. A3R procedures**
- 6. Contingencies**



WORKING GROUP 6
SYSTEMS REQUIREMENTS & VERIFICATION METHODS
BOOM-RECEPTACLE SYSTEM AND INTERFACE RECOMMENDED REQUIREMENTS
ARSAG DOCUMENT NO. 02-88-12R2

STATUS OF DOCUMENT :

In for Signatures

PURPOSE OF DOCUMENT:

To correct an unsatisfactory requirement in the existing ARSAG document and the NATO Requirements document ATP 3.3.4.5 (STANAG 7191).

SCOPE OF DOCUMENT:

This revision corrects the boom telescoping system coupled push-pull load requirement, to be compatible with light receiver aircraft such as the A-10.

HARRY W. SLUSHER
DOCUMENT MANAGER
BOEING LONG BEACH
562-810-3323
harry.w.slusher@boeing.com



CONTENTS OF DOCUMENT

KEY ELEMENTS OF BOOM-RECEPTACLE RECOMMENDED REQUIREMENTS DOCUMENT

- **ONE PRIMARY CHANGE – BOOM COUPLED (UNCOMMANDED) PUSH-PULL LOADS**
- **EXISTING REQUIREMENT IS INCORRECT**
- **EXISTING MINIMUM PUSH PULL LOAD TOO HIGH FOR A-10 TO MOVE FORWARD**
- **REVISED REQUIREMENT BASED ON SUCCESSFUL EXISTING TANKERS**
- **ARSAG DOCUMENT BEING COORDINATED WITH NATO JAPCC TO BE INCLUDED IN CURRENT REVISION TO NATO ATP 3.3.4.5 (STANAG 7191)**

Harry Slusher



WORKING GROUP 6
SYSTEMS REQUIREMENTS & VERIFICATION METHODS
GUIDANCE DOCUMENT – AERIAL REFUELING BOOM/RECEPTACLE
ARSAG DOCUMENT NO. 20-08-17R1

STATUS OF DOCUMENT :

- **50 % COMPLETED**
- **Goal is to Release by ARSAG 2020**

PURPOSE / BENEFITS OF DOCUMENT

- **Supplements the NATO Boom/Receptacle Requirements Document, ATP 3.3.4.5**
- **Provides reasons, guidance, background and lessons learned from past designs**

SCOPE OF DOCUMENT

- **All Aspects of Tanker and Boom Systems Design**
- **All Aspects of Receiver and Receptacle Systems Design**
- **All Aspects of Boom/Receptacle interface**
- **All Aspects of Tanker/Receiver System Function**

HARRY W. SLUSHER
DOCUMENT MANAGER
BOEING LONG BEACH
562-810-3323
harry.w.slusher@boeing.com



Key Elements of the Boom/Receptacle Guide Document

- 1. Extensive revision, well under way.**
- 2. To include lessons learned (the hard way) from KC-135, KC-10, KDC-10, KC-767 and KC-46 system design and in-service.**
- 3. Provide, where possible, the reasons for specific requirements in NATO ATP 3.3.4.5**
- 4. All additional available guidance to assist future designers of Tankers and Receivers**
- 5. All inputs, suggestions, complete write-ups are VERY WELCOME.**
- 6. Contact Harry Slusher, 562-810-3323, harry.w.slusher@boeing.com**



WORKING GROUP 6

Systems Requirements and Verification

Aerial Refueling Documents Reference Guide

ARSAG DOCUMENT 52-18-19WD

STATUS : Just Initiated – Determining Structure

PURPOSE / BENEFITS OF DOCUMENT:

- **Provide a guide document that references and provides context to the many AR related documents that exist. Provides a “big picture” of what is available, what they provide, how they are used, how the “pieces fit together”, and ID possible gaps and/or redundancies. Should include all ARSAG doc’s posted to DTIC & ASSIST.**

SCOPE OF DOCUMENT

- **Should include all ARSAG doc’s posted to DTIC & ASSIST.**
- **Will include any other available documents as able**
- **Specs, Requirements, JSSGs, Guide Documents, Handbooks, etc**

Thomas J Pitsor
USAF AFLCMC/EZFA



CONTENTS OF DOCUMENT

- 1. Title, Date, Reference number, Author, Organization, etc. of referenced document**
- 2. Summary of contents – What it covers (Requirements? Testing? Technical Info?)**
 - Just a few sentences, a short executive summary**
- 3. How/Why this document may be useful**
- 4. Where it can be found**



WORKING GROUP NUMBER 6
System Requirements and Verification Methods
Doc Title: Probe Drogue Interface and System Requirements
ARSAG DOCUMENT NUMBER: 57-18-19WD

STATUS OF DOCUMENT:

- **25% COMPLETED**

PURPOSE / BENEFITS OF DOCUMENT

- The purpose of this ARSAG document is to facilitate probe-drogue aerial refueling between aircraft of cooperating forces by defining probe-drogue aerial refueling systems requirements and standardizing the interfaces required to engage in probe-drogue refueling operations.

SCOPE OF DOCUMENT

- Recommended revisions and additions to ATP 3.3.4.6 (STANAG 3447) for inclusion in the next revision to the NATO documents. NATO comments on the content of the existing NATO documents are being reviewed and will be included in this ARSAG document.

Derek Ferwerda (NAVAIR) & Pablo Martinez (Airbus)



CONTENTS OF DOCUMENT

- 1. Coupling Mating Dimensions and Drogue Clearance Envelope**
- 2. Coupling Engagement, Disengagement, and Latch Forces**
- 3. Hose Reel extension, retraction, and response characteristics**
- 4. Probe Nozzle Physical Interface**
- 5. Probe Mast Clearance Envelope and Stay Out Zones.**
- 6. Probe Design Loads**



WORKING GROUP 6

SYSTEMS REQUIREMENTS AND VERIFICATION METHODS

AERIAL REFUELING MODELING AND SIMULATION GUIDE

ARSAG DOCUMENT 52-18-19WD

- **STATUS OF DOCUMENT**

- JUST INITIATED

- **PURPOSE**

- Develop a standardized format (Interface Control Document) and validation/verification best practices for the modeling and simulation of Aerial Refueling Systems.

- **BENEFITS OF DOCUMENT**

- Reduce the cost and resources required to carry out performance evaluation, system design, integration, flight test, certification, clearance, training and mishap evaluation.
- Standardized model architecture
- Defined model component interface definitions
- Documented best practices for component level and end-to-end simulation validation/verification

- **SCOPE OF DOCUMENT**

- Modeling and simulation of Aerial Refueling Systems:
 - hose/drogue
 - boom/receptacle
 - BDA (boom-to-drogue adaptor) kit configurations

**Elizabeth Knoblauch, Document Manager
US Dept of Defense- Navy (NAVAIR)**



ARSAG Working Group 6

Modeling and Simulation Standardization

Anticipated Document Content

- **Interface Control Document of Aerial Refueling Simulation Model Components**
 - Defines and diagrams all model components and their interfaces including inputs and outputs
 - Enables standardized model architecture, compatibility, and exchange
- **Simulation Subsystem**
 - Component characteristics: structure, weight, aerodynamics, material properties
 - Mapping to real world components and subsystem configurations
 - Validation data and best practices for model validation/verification
- **Full Simulation**
 - System level identifications and mapping to certified systems
 - Validation data and best practices for model validation/verification
- **Application of Modeling and Simulation as a Tool for Aerial Refueling Certification Process-**
- **Environmental Factors**
 - Turbulence models and definitions
 - Tanker airwake models
 - Receiver bow-wave models
- **Other Model Components**
 - Visual model representation in manned simulation

Elizabeth Knoblauch, Document Manager
US Dept of Defense- Navy (NAVAIR)



ARSAG Working Group 6

Modeling and Simulation Standardization

- **Current Working Group Members**

- Feb 2019 working group meeting

- BOEING Ian Fialho

- COBHAM Henry Clarke

- CTSi Kenny Boothe

- MIDE Attila Lengyel, Marthinus van Schoor

- NAVAIR Liz Knoblauch

- SDI Andrew Erickson

- **Meeting Schedule**

- Monthly Telecom Meeting 1st Friday, 11am eastern standard time

- ARSAG Working Group Workshops - 10-12 Sept 2019- Dayton, Ohio

- **Join**

- Contact: Henry Clarke, team lead Henry.Clarke@cobham.com

- **Requirements & Applications**

- If you have ideas for other applications please contact us to feed your requirements into the group



Elizabeth Knoblauch, Document Manager
US Dept of Defense- Navy (NAVAIR)