

EXAMINATION OF COMMERCIAL AERIAL REFUELING  
AS PART OF THE NATIONAL DEFENSE STRATEGY

By

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Title of Study: EXAMINATION OF COMMERCIAL AERIAL REFUELING AS PART  
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Abstract: The purpose of this study was to analyze current military and commercial air-to-air refueling capabilities. With that, technical and training requirements, liabilities, procurement of parts, as well as obsolescence of those parts, and overall sustainment impediments for commercial air-to-air refueling companies wanting to or performing air-to-air refueling for all branches of U.S. military service were considered. Commercial air-to-air refueling plays an important role for the United States Navy and the United States Air Force is currently trying to determine if they also need these commercial capabilities. By taking an in-depth look at air-to-air refueling, we will determine how the U.S. government will meet the intent of the National Defense Strategy.

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## ACRONYMS

A&S	Air and Space
AAR	Air-to-Air Refueling
ADS-B	Automatic Dependent Surveillance-Broadcast
AFLCMC	Air Force Life Cycle Management Center
AFSOC	Air Force Special Operations Command
AMC	Air Mobility Command
AMP	Aircraft Modernization Program
ARCA	Aerial Refueling Certification Agency
ASES	Avionics Sustaining Engineering Services
ATA	Air Transport Association
BDA	Boom-Droge Adapter
BOM	Bill of Materials
CAS	Contracted Air Services
CDS	Centerline Drogue System
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
COE	Center of Excellence
COMBS	Contractor Operated and Maintenance Base Supply
CSTO	Country Standard Technical Order
DAG	Defense Acquisition Guidebook
DAR	Designated Airworthiness Representative
DDCMO	DEMIL Coding Management Office
DDPM	DoD DEMIL Program Manager
DEMIL	Demilitarization
DLA	Defense Logistics Agency
DMSMS	Diminishing Manufacturers Shortages Material Shortages
DoD	Department of Defense
DoN	Department of Navy
DoS	Department of State
DSCA	Defense Security Cooperation Agency
ETMS	Enhanced Technical Management System
FAA	Federal Aviation Administration
FACH	Chilean Air Force
FAR	Federal Acquisition Regulation
FMS	Foreign Military Sales

FSR	Field Service Representation
FY	Fiscal Year
GA	General Aircraft
GAO	Government Accountability Office
GFE	Government Furnished Equipment
HASC	House Committee on Armed Services
IARS	Integrated Air Refueling System
IDIQ	Indefinite Delivery Indefinite Quantity
IPB	Illustrated Parts Breakdown
IRB	Institution Review Board
ISR	Intelligence, Surveillance, and Reconnaissance
JAPCC	Joint Air Power Competence Centre
JG	Job Guide
LOA	Letter of Offer and Acceptance
MDS	Mission Design Series
MPRS	Multi-Point Refueling System
MRO	Maintenance, Repair, and Overhaul
MRTT	Multi-Role Tanker Transport
NAICS	North American Industry Classification System
NATO	North Atlantic Treaty Organization
NAVAIRSYSCOM	Naval Air Systems Command
NDAA	National Defense Authorization Act
NDS	National Defense Strategy
NSS	National Security Strategy
OC-ALC	Oklahoma City Air Logistics Complex
OCONUS	Outside the Continental United States
OEM	Original Equipment Manufacturer
OMB	Office of Management and Budget
OSU	THE Oklahoma State University
PDM	Programmed Depot Maintenance
PN	Partner Nation
PWS	Performance Work Statement
Q&A	Question and Answer
RFP	Request for Proposal
RQ	Research Questions
RVSM	Reduced Vertical Separation Minimum
SA	Security Assistance
SAMM	Security Assistance Management Manual
SC	Security Cooperation
SME	Subject Matter Expert
SOW	Statement of Work

SPO	System Program Office
SRD	Standard Related Document
TM	Technical Manual
TO	Technical Order
TPT	Third Party Transfer
TurAF	Turkish Air Force
U.S.	United States
URC	University Research Compliance
USAF	United States Air Force
USG	United States Government
USMC	United States Marine Corps
USN	United States Navy
USTRANSCOM	United States Transportation Command
WARP	Wing Aerial Refueling Pods

## CHAPTER I

### INTRODUCTION

In 1921, a wing walker steadily walked along the wing of a Lincoln Standard and hand-poured gas into a Curtis JN-4 (History of In-flight Refueling, n.d.). Additionally, in 1923, the United States (U.S.) Army de Havilland DH-4B refueled another DH-4B using a rubber hose, a process known then as “you dangle it; I’ll grab it” (Smith, 1998, p. 1). The Question Mark, a Fokker C-2 aircraft, was refueled by a Douglas C-1 transport aircraft that was modified adding two 150-gallon tanks to support aerial refueling in 1929 (Wallwork et al., 2009). There has always been much debate as to when the first aerial or air-to-air refueling (AAR) activity occurred, but AAR has historically been necessary to support military operations.

The Department of Defense defines AAR as “the process of transferring fuel from a military tanker aircraft to another military aircraft, including fixed-wing jets and helicopters” (Vergun, 2020, para. 2). There are two main types of AAR: (1) hose-and-drogue or probe-and-drogue type refueling and (2) boom refueling. The hose-and-drogue (Figure 1) utilizes a hose that extends from the wingtip or fuselage with a drogue on the end of the hose that looks like a basket. Once the hose is extended, the probe is maneuvered into the basket to fit securely and the fuel is pushed through (Editorial Team, 2020).

The boom (Figure 2) requires an operator who sits in the back of the airplane. The operator uses a joystick-type controller which navigates the telescoping tube that inserts into the receiving aircraft's receptacle. While both types of refueling methods are used, boom refueling is much quicker. A boom can transfer approximately 6,000 pounds of fuel per minute, whereas the hose-and-drogue method can only transfer between 1,500-2,000 pounds per minute (Bolkom, 2006).

Figure 1. *KC-46 utilizing hose-and-drogue refueling to perform AAR*



Figure 2. *KC-135 utilizing boom refueling to perform AAR on a B-1 Lancer*



As of January 2021, there are six main military AAR aircraft, commonly known as “tankers” in the U.S.: (1) the United States Air Force (USAF) KC-135 Stratotanker, (2) the USAF KC-10 Extender, (3) the USAF KC-46 Pegasus, (4) the USAF HC/MC-130, (5) the United States Marine Corp (USMC) KC-130/130J, and (6) the United States

Navy (USN) F/A-18E/F (NATO Joint Air Power Competence Centre, 2021). These aircraft either have a hose-and-drogue or boom refueling capability, or have both. Two aircraft can be refueled simultaneously using called a Multi-Point Refueling System (MPRS). In addition, Boeing has developed an unmanned aircraft for the USN called the MQ-25 Stingray. Its primary function is AAR, but it also has the capabilities for intelligence, surveillance, and reconnaissance (ISR). The MQ-25 goal is to deliver up to 15,000 pounds of fuel and up to 500 nautical miles from the carrier (Lagrone, 2021).

Today, AAR has become more important than ever as the U.S. government focuses on building a more lethal military force and rebuilding readiness which is part of the 2018 National Defense Strategy (NDS) (Office of U.S. Secretary of Defense, 2018). Aside from military AAR, there are three commercial refueling companies that have contracted or want to contract with the U.S. military, U.S. government agencies, or partner nations (PNs), to perform AAR that will be discussed in this study. The first is Omega Air, an Alexandria, Virginia company led by retired military and civilian personnel. Their aircrew is “comprised of experienced military pilots, including numerous former Air Force aerial refueling tanker pilots” (Omega Air, 2020, para. 2). The USN is the AAR Operations Certification Agency for Omega’s aircraft and holds its airworthiness certification for refueling (NATO JAPCC, 2021). Omega provides or has provided AAR support to Red Flag, a combat training exercise that includes the U.S. and its PNs, USMC deployed units, the Blue Angels, and more (Omega Air, 2020). Omega owns the following types of aircraft: KC-707A, KC-707B, KC-707C, KDC-10/MPTT, and lastly the KDC-10 (NATO JAPCC, 2021).

A second company is Tempus Applied Solutions/TriStar. Tempus is a Newport News, Virginia company that purchased six Lockheed L-1011s to focus attention on military customers in the USA and North Atlantic Treaty Organization (NATO) that have a need for air-to-air refueling services (Terry, 2018 para. 2). TriStar, a subsidiary of Tempus Applied Solutions, is not known to currently perform any commercial AAR services.

Military Aerial Refueling Solutions is a third company. According to their website, they have started the process of developing plans to support refueling needs of the U.S. military (MARSolution Services, LLC, n.d. para. 1). The website also indicates the company is trying to determine the best platform to perform AAR. Military Aerial Refueling Solutions is not known to currently perform any commercial AAR services.

### **Statement of the Problem**

The USAF tankers have been in service for over 65 years successfully performing prescribed missions. However, the USN is not convinced that the USAF can continue to fulfill their mission requirements due to a shortfall of USAF tankers; therefore, the USN initiated contracts for commercial AAR to meet their ongoing refueling needs.

Additionally, the USAF is also considering commercial AAR after the House Committee on Armed Services or commonly known as the House Armed Services Committee (HASC), stated they were “aware that as many as 30,000 hours of aerial refueling missions are not being supported annually” (Department of the Air Force, 2020, p. 2). Because there are so many military tankers currently in service, and more to be put into service (i.e. KC-46), additional research is required to determine if commercial AAR is beneficial to the NDS. These benefits may include using these commercial refueling



services for training exercises, testing aircraft, or other requirements from both the military and private sector entities.

### **Purpose of the Study**

The purpose of this study was to analyze current military and commercial AAR capabilities, technical and training requirements, liabilities, procurement of parts, as well as obsolescence of those parts, and overall sustainment impediments for commercial AAR companies wanting to or performing AAR for all branches of U.S. military service.

### **Research Questions**

To determine if commercial refueling is beneficial to the NDS, there were four research questions that were explored with regards to having commercial refueling companies perform AAR and not the USAF, USMC, and USN. Research questions (RQs) include:

RQ1: In 2021, there are 400+ U.S. military tankers in service. With this many U.S. taxpayer-funded military tankers currently in service, why is the USN already utilizing commercial AAR services, and the USAF is seriously considering it?

RQ2: Regarding refueling collisions, damage to the aircraft, or other mishaps during AAR missions, will the commercial refueling companies be responsible for all collateral damage to U.S. military aircraft and aircrews?

RQ3: How will the U.S. government ensure the commercial refueling companies properly operate and maintain their aircraft during the contract period of performance?

RQ4: How will the commercial refueling companies properly obtain approval for receiving and operating boom-equipped aircraft purchased from partner nations?

### **Significance of Study**

The significance of this study is to explore commercial AAR and determine if it should be considered as part of the NDS. Results from the study will be shared with multiple government agencies (e.g. Federal Aviation Administration) as well as leadership within the military branches, in anticipation that the outcome of the study will determine if commercial AAR should be researched further, implemented, or ceased for all agencies and military branches of service.

### **Assumptions, Limitations and Delimitations**

Assumptions in a study are assumed true by those who will participate or read the study. In this study, there were two assumptions. The first assumption is that research participants have knowledge of tankers; including one or more types of AAR aircraft. The participants are current or retired federal, military, or U.S. government contractor personnel who live and work in the U.S., and U.S. citizens who live and work outside of the continental U.S. (OCONUS). Participants will also have knowledge and/or access to applicable rules and regulations as it relates to military or commercial aerospace operations. The second assumption is that there may be subjectivity from the commercial AAR companies who have or may perform AAR for the U.S. government and military branches of service.

Limitations in a study are potential weaknesses of the study that outside the control of the researcher. There were five limitations in this study:

- 1.) Some individual responses could be considered political or generic in nature, and are not meaningful or give a sense of autonomy. This could be due to individuals who are not in a position or authority to answer questions on behalf of an organization. Or, organizations did not want to put themselves in a position where they could be releasing trade secrets. A trade secret “consists of secret knowledge used in a business, not previously available, and not known to a business's competitors” (Federation of American Scientists, n.d., para. 18).
- 2.) Lack of responses from key stakeholders from both the public and private sector, to include additional commercial AAR companies. Not providing responses would have given additional commercial AAR companies an opportunity to promote their company and capabilities.
- 3.) The researcher is a USAF civilian and did not use sources that have not been released to the public as it relates to AAR. All research information was obtained through external sources and cited accordingly, which eliminates any perception of conflict of interest on behalf of the researcher.
- 4.) Some research participants did not want to be identified personally by name or company. Therefore, the researcher identified all research participants as “Research Participant [A-I]”.
- 5.) Obtaining data from U.S. government agencies, military branches of service, along with commercial AAR companies and private sector resulted in “Proprietary to Contractor XYZ” or non-responsiveness.

Delimitations were considered as part of this study. The only delimitation set by the researcher was not including commercial AAR companies located OCONUS that were foreign companies. This was due to the study focusing on U.S. AAR capabilities.

### **Definition of Terms**

This section provides definitions of terms that are used throughout this study:

AAR – Air to Air Refueling is the process of transferring fuel from a military tanker aircraft to another military aircraft, including fixed-wing jets and helicopters (Vergun, 2020).

AMPs – Aircraft Modernization Programs modernize or upgrade aircraft to meet the requirements and requests of the customer. These AMPs can include upgrades such as replacing analog instruments or adding a required capability like Automatic Dependent Surveillance-Broadcast (ADS-B) which is mandated by the Federal Aviation Administration (FAA) (Department of Defense, 2021).

DoS – The Department of State “advises the President and leads the nation in foreign policy issues. The State Department negotiates treaties and agreements with foreign entities, and represents the United States at the United Nations” (Department of State, n.d. para. 1).

FAA – The Federal Aviation Administration is the regulator of all the nation’s civil aviation activities, including management of air traffic in U.S. airspace, managing more than 50,000 U.S. commercial and general aviation flights daily (Federal Aviation Administration, 2018).

GAO – The U.S. Government Accountability Office “is an independent, non-partisan agency that works for Congress. GAO examines how U.S. taxpayer dollars are spent and

provides Congress and federal agencies with objective, non-partisan, fact-based information to help the U.S. government save money and work more efficiently” (U.S. Government Accountability Office, n.d., para. 1).

MPRS - Multi-Point Refueling Systems provide hose-and-drogue and boom refueling at the same time using a boom-drogue adapter (BDA). This adapter is installed prior to flight and limits the aircraft to only refueling with the drogue on any mission where it is installed. Using the MPRS provides two drogue-refueling points at the KC-135's wingtips without affecting the centerline boom's capability.

National Defense Strategy – The NDS “provides a clear road map for the Department of Defense to meet the challenges posed by a re-emergence of long-term strategic competition with China and Russia. The National Defense Strategy acknowledges an increasingly complex global security environment, characterized by overt challenges to the free and open international order” (Department of Defense, n.d. para. 1).

Original Equipment Manufacturer – “Means a company that manufactures products that it has designed from purchased components and sells those products under the company's brand name” (Code of Federal Regulations, n.d., para. 24).

Partner Nations – “Partner Nations are those countries with which we share common values and the goal of eradicating the scourge of terrorism, and with which we cooperate to safeguard these values and achieve this goal. They play an invaluable role in enhancing U.S. counterterrorism efforts” (Department of State, n.d., para. 1).

Programmed Depot Maintenance – Maintenance performed on a weapon system that occurs based on a schedule versus when the weapon system has a specific condition that

needs addressing. Programmed Depot Maintenance extends the life of the aircraft along with its capabilities.

Standard Related Document - Source document that planners and the aircraft crew must reference for both receiver and tanker assets to determine compatibility and clearance.

SRDs contain operational information and national and organizational contacts.

Third Party Transfer – A transfer of an item to a new end-user.

## CHAPTER II

### LITERATURE REVIEW

A review of literature is included to ensure a thorough assessment of sources and methodology for the research study. The review includes information relevant to the interpretation and results of the research. This includes: (1) the National Defense Strategy, (2) AAR aircraft capabilities, (3) the Air Mobility Command (AMC) commercial refueling study published in April 2020, (4) commercial AAR services solicited by the U.S. Navy, (5) a listing of commercial AAR contractors, (6) the process of third party transfers from PNs to other PNs or commercial AAR companies, (7) foreign military sales, (8) applicable technical data, (9) airworthiness and FAA requirements for AAR aircraft, (10) liability, training, and sustainment considerations for commercial AAR companies.

#### **National Defense Strategy**

The focus of the National Defense Strategy is on the Department of Defense (DoD's) role to implement the President of the United States' National Security Strategy (NSS). Its origination was through Congress as part of the National Defense Authorization Act for FY17 (which is Public Law 114-328), as well as through the National Security Act of 1947, to replace the Quadrennial Defense Review. The first NDS report was published in 2005 and is republished every four years. The objective of

republishing the report is to remind Americans how the DoD will maintain security and success across the globe.

The NDS “articulates our strategy to compete, deter, and win in this environment. The reemergence of long-term strategic competition, rapid dispersion of technologies, and new concepts of warfare and competition that span the entire spectrum of conflict require a Joint Force structured to match this reality” (Office of the Secretary of Defense, 2018, p. 1). The latest NDS was signed in 2018 by then Secretary of Defense Retired General Jim Mattis. As part of the 2018 NDS, the most recent published NDS report, two of its strategic objectives were to deliver performance with speed and sustaining joint forces in the U.S. and globally. To meet these objectives, the tanker plays a critical role in both moving military personnel (when required) and refueling for branches of services’ aircraft, thus delivering performance with speed and sustaining joint forces, during peacetime and wartime for training and operations. The National Defense Authorization Act (NDAA), led by the Senate Armed Services Committee and HASC, is more operational based versus strategic, sets policy, and aligns resources (e.g. tankers) to implement the NDS.

The NDAA authorizes appropriations for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, and to prescribe military personnel strengths for such fiscal year and for other purposes (S. Rept. 116-236 - National Defense Authorization Act for fiscal year 2021, 2020, p. 1). The HASC “recommends a provision that would prohibit the divestment of KC-10 and KC-135 aircraft in excess of the following: in fiscal year 2021, 6 KC-10s; in



fiscal year 2022, 12 KC-10s; and, in fiscal year 2023, 12 KC-10s and 14 KC-135s”  
(Committee on Armed Services United States Senate, 2020, p. 14).

### **AAR Aircraft Capabilities**

The NDS states that it is vital for the U.S. military to continue to be a lethal force through modernization. Air-to-air refueling capabilities include all tankers that can, will, and do perform AAR as well as aircraft that can receive fuel. Tankers that are older than 50 years old are refueling fighters that are less than 15 years old (i.e. F-35) which is a technological leap. Thus, upgrading capabilities of older tankers to meet the needs of newer receiver aircraft helps ensure the U.S. military continues to be a lethal force through modernization.

To provide expertise for Joint Air and Space (A&S) power not previously in NATO, and to ensure modernization of the force, the Joint Air Power Competence Centre (JAPCC) was formed in 2005. JAPCC was accredited as NATO’s first Centre of Excellence (COE). JAPCC hosts AAR conferences with attendees across the world, along with meetings to share changes and news within the AAR community. In addition, JAPCC publishes AAR related documents on their website that were searched for and abstracted by the researcher to include Standard Related Documents (SRDs) and JAPCC white papers.

SRDs provide tanker aircrews with pertinent information as it relates to U.S. military, foreign, and commercial aircraft receivers to take in fuel. Conversely, it provides the U.S. military, foreign, and commercial aircraft with needed information regarding tankers and refueling. As an example, the SRD will specify a certain tanker, and then will list all applicable foreign military [aircraft] receivers that are compatible

with that tanker. The SRD also has information regarding tanker dimensions, fuel transfer rates, refueling heights and speeds, and other related information to that specific tanker. The SRD is generally used in conjunction with relevant technical data.

According to the SRD, the Boeing KC-135 utilizes the boom and hose-and-drogue for AAR. “There is one refueling mounted flyable boom for boom-type refueling. The boom can be modified to refuel probe-equipped aircraft by fitting a BDA; the BDA can only be fitted/removed on the ground. Approximately twenty aircraft have the capability to be fitted with two FRL MK32B-753 wingtip mounted MPRS AAR pods” (NATO JAPCC, 2021, p. 4-1). The KC-135 is certified for varying types of receiver aircraft, not to include the multiple variances. The receiver aircraft includes but is not limited to: the F-35, C-32, and B-2. The KC-135 is managed by the Program Office, Air Force Life Cycle Management Center (AFLCMC), Tinker Air Force Base (AFB) (Sorial, 2019). The Oklahoma City, Air Logistics Complex (OC-ALC) Tinker AFB provides all organic Programmed Depot Maintenance (PDM) support for both the aircraft and the engine (Sorial, 2019). Boeing is the Original Equipment Manufacturer (OEM) of the aircraft and provides engineering services for the KC-135 (LaPorta, 2018). Collins Aerospace supports the avionics on the KC-135 through its own contract, the Avionics Sustaining Engineering Services (ASES) contract, which has performed AMP and OEM avionics support for the KC-135 like ADS-B out and Mode 5 (Carey, 2019). The KC-135 was set to retire some of its fleet in fiscal year (FY) 21, but was denied permission from the HASC to retire the aircraft through FY23 (Everstine, 2020). In July 2021, the House backed the USAF in allowing for gradual retirements for the KC-135 (Cohen,

2021). However, as of today, the NDAA has not been signed allowing for such retirement.

There are three current PNs who use the KC-135: France Air Force (FAF), who owns the C/KC-135Rs, recently decommissioned their first aircraft last year as they are retiring their fleet over the next 10 years and are moving to the Airbus' A330 Multi-Role Tanker Transport (MRTT) (Pingstone, 2020); the Chilean Air Force (FACH) has KC-135E model aircraft (WDMMA, n.d.) and the Turkish Air Force (TurAF) has KC-135R aircraft (Sunnetci, 2021). Singapore was a previous PNs for the KC-135 but they decommissioned their aircraft and started operating the Airbus A330 MRTT (Chuanren, 2019).

The McDonnell Douglas KC-10 utilizes the boom and hose-and-drogue for AAR. “There is one centerline flyable boom for boom-type refueling. Additionally, a Sargent Fletcher fuselage mounted hose drum unit is fitted for probe and drogue operation. Approximately twenty aircraft have the capability to be fitted with two Flight Refueling Ltd MK32B wing mounted AAR pods; these are known as Wing Aerial Refueling Pods (WARPs)” (NATO JAPCC, 2021, p. 5-1). The KC-10 is certified for varying types of receiver aircraft, to include the multiple variances. These receiver aircraft include but is not limited to: the A-10, B-52, VC-25, and “proven” aircraft like the F-4 Phantom (NATO JAPCC, 2021, p. 8-6). The KC-10 program is managed by the Program Office at Tinker AFB (Sorral, 2019). Vertex Aerospace, formerly known as L3, supports the sustainment of the aircraft as the maintenance, repair, and overhaul (MRO) and Contractor Operated and Maintained Base Supply (COMBS) contractor, and provides Field Service Representation (FSR) (Business Wire, 2016). The KC-10 is set to retire its

entire fleet (Eagan, 2020). The Netherlands were the only PN for the KC-10 (Sorial, 2019) and had two KDC-10 aircraft, but decommissioned and sold them to Omega Air (Reim, 2019). The second of the two sold aircraft recently left the Netherlands on October 25, 2021 and was flown to Omega Air (Orban, 2021).

The KC-46 provides hose-and-drogue and boom refueling. “There is one centerline flyable boom for boom-type refueling. Additionally, a Centerline Drogue System (CDS) is mounted in the aft fuselage of the aircraft for probe and drogue operation. All aircraft have the capability to be fitted with two wing mounted AAR WARPs” (NATO JAPCC, 2021, p. 6-1). The KC-46 is certified for varying types of receiver aircraft, not to include the multiple variances. These receiver aircraft include but is not limited to: the C-5, F-15, and F-18 (NATO JAPCC, 2021, 8-8). The KC-46 is currently used by four locations: McConnell AFB, Altus AFB, Pease ANG Base, and Seymour-Johnson AFB (Cisneros, 2020). In addition, Japan accepted its first KC-46 in October 2021. The KC-46 program is managed by the KC-46 System Program Office (SPO); AFLCMC, Wright-Patterson AFB and Tinker AFB (Sorial, 2019). Boeing is the OEM and Tinker AFB provides maintenance checks on the aircraft (Sorial, 2019). The KC-46 is the replacement for the retiring KC-10 fleet, as well as for the aging KC-135, though the KC-135 is planned to be in service through 2050 or longer (Everstine, 2019). There have been major problems with the fielding of the KC-46 such as electrical and wiring issues, the vision system for the boom, and overall engineering and manufacturing shortfalls (Everstine, 2020).

The HC/MC-130 has a unique role. In addition to refueling, it also provides mobility support for ground tactical units. “The HC/MC-130 has 2 drogue equipped

refueling stations, one mounted on each wing outboard of the engines. There are five Mission Design Series (MDS) aircraft in this category: HC- 130N/P, HC-130J, MC-130H, MC-130P, and MC-130J. Three MDS (HC-130N/P and MC-130P) have the Sargent Fletcher 48-000-4 refueling pod. MC-130H aircraft have the Integrated Air Refueling System (IARS) refueling pod. Two MDS (HC/MC-130J) have the Sargent Fletcher 48-000-6 refueling pod. Each type of refueling pod has different characteristics and pod status lights. Receivers should confirm which of the MDS tankers they will be refueling from” (NATO JAPCC, 2021, p. 7-1). The HC/MC-130 is certified for varying types of receiver aircraft, to include the variances. These receiver aircraft include but is not limited to “all H-47, H-53, and H-60 series probe equipped helicopters as well as V-22 series tilt-rotor aircraft are certified to receive fuel from HC/MC-130 aircraft. All other receivers must meet provisions of MIL-HDBK-516, paragraph 8.7, before seeking receiver certification” (NATO JAPCC, 2021, p. 7-15). The HC/MC-130 is currently used by active duty Air Reserve Components and operated by the Air Force Special Operations Command (AFSOC) (Department of Defense, 2016, p. 5). The HC/MC-130 program is managed by AFLCMC, Wright-Patterson AFB (Brackens, 2018). Lockheed is the OEM for the aircraft (Air Force, n.d.).

The USMC KC-130J “has two drogue-equipped aerial refueling stations, one mounted on each wing outboard of the engine. Each refueling station consists of a Sargent Fletcher 48-000 refueling pod, 93 feet of hose, either a MA-3, or MA-3-1 reception coupling and a 30-inch diameter high-speed fixed wing or 47-inch diameter low-speed helicopter paradogue. Helicopters may not refuel from a high-speed drogue. The KC-130J has fuel pumps in the AR pods to increase AR fuel flow to compatible

receivers” (NATO JAPCC, 2021, p. 3-9). The KC-130 is certified for varying types of receiver aircraft, to include the multiple variances. These receiver aircraft include but is not limited to: the USMC AV-8B, the MH-53, and UH-60 (NATO JAPCC, 2021). Lockheed is the OEM for this aircraft (Lockheed Martin, n.d.).

The F/A-18 is mostly used as a combat aircraft. However, “the [USN] F/A-18E/F Super Hornet can be converted to the tanker role by fitting an externally carried AAR Store to its centerline station” (NATO JAPCC, 2021, p. 3-28). The F/A-18E/F is certified for varying types of receiver aircraft, to include the multiple variances. These receiver aircraft include but is not limited to: the USMC AV-8B, the MH-53, and UH-60 (NATO JAPCC, 2021). McDonnell Douglas is the OEM for this aircraft (Boeing, n.d.).

The MQ-25 is not part of the SRD as it is still in the testing phase. Its most recent successful refueling tests included refueling the F-35, F/A-18, and the E-2D. The latest test was held was in September 2021 and led by the Naval Air Systems Command (NAVAIR) alongside the F-35 program office.

### **The Air Mobility Command Commercial Refueling Study**

The Air Mobility Command refueling study was a benchmark tool to help the researcher expand upon information that was part of the refueling study, such as USAF’s flying hour costs compared to commercial refueling costs which is discussed in greater detail in Chapter IV.

This refueling study was initiated by United States Transportation Command (USTRANSCOM), authored by USAF personnel working for AMC, a Command falling under the USTRANSCOM, and signed by Barbara Barrett, U.S. Secretary of the Air

Force on April 22, 2020 to determine if commercial refueling would be a benefit to the USAF. The study was directed by the HASC.

Within the study, it discussed various previous commercial refueling studies, feasibility of commercial AAR, affordability of commercial AAR, advisability of AAR, and where tankers could be procured from for commercial AAR companies. In addition, it discussed the feasibility of contractors performing AAR using government furnished equipment (GFE) (e.g. government owned KC-135s, KC-10s, etc.).

Ultimately, the report found that additional research would be required due to the legal, regulatory, and financial challenges. In addition, “per 10 U.S.C. 129a and 2463, before a contract solution can be adopted that outsources a function currently performed organically, a comparison must be made with the cost of providing the same service” (Department of the Air Force, 2020, p. 3).

### **Commercial AAR Services Solicited by the U.S. Navy**

According to the USN Solicitation #N0042120R0094, “Solicitation, Offer, and Award” updated on July 27, 2020, 4.4.4 CLIN [Contract Line Item Number] - “The Offeror shall propose its flight minute rate. This rate multiplied by the maximum quantity of 150,000 flight minutes shall not exceed \$57,000,000.00” (SAM.gov, 2020). This updated CLIN explains how contracted flight minutes are calculated for the initial ordering period. The calculations equate to \$380.00 per flight minute or \$22,800.00 per flying hour.

The solicitation also stated, “the Government contemplates award of a Fixed Priced Multiple Award Indefinite Delivery Indefinite Quantity (IDIQ) contract resulting

from this solicitation” (SAM.gov, 2020). This implies the U.S. Navy could contract with more than one commercial AAR company to perform AAR services for them.

To compare, according to the CRR-FY20 Contractor-Operated Aerial Refueling Aircraft Study, the Ownership Cost per flying hour, in 2019, which includes the cost of the fuel of the KC-10 was approximately \$23,000 per flying hour and the KC-135 was approximately \$26,000 per flying hour” (Department of the Air Force, 2020).

Taking into consideration top-down cost estimation and current year inflation rates, the costs between the commercial AAR USN solicitation and Air Force aircraft support are similar, even after considering inflation rate adjustments for the current year compared to when the USAF study received their data for FY19 flying hour rates. However, this does not consider future years and the increase sustainment costs to include obtainment of parts. In addition, this does not include KC-46s flying hour costs which are presumed to be higher than the KC-10 and KC-135 due to cost overruns.

### **Listing of Commercial AAR Contractors**

Historically, there has only been one commercial AAR contractor, Omega Air, which has performed refueling services for the U.S. government. Additional companies are newer to commercial AAR and are currently attempting to procure tanker aircraft, competing for Navy contracts, or standing up new operations.

Contracted Air Services (CAS’) for AAR were originally directed by the Department of Defense in 2001 to the USN to meet the USN’s peacetime training requirements (Department of the Air Force, 2020). Omega Air has been providing contracted services since 2001. “Omega operates under a contract with the Naval Air Systems Command (NAVAIRSYSCOM) PMA 226 to support USN and USMC flight



operations worldwide. Users are not charged a fee for using Omega as all costs are covered under the NAVAIRSYSCOM contract. Omega allocates fuel in the same manner as any military base or airport with a government fuel contract” (Omega Air, 2021, para. 1). Omega Air operates under the North American Industry Classification System (NAICS) code 488190, “Other Support Activities for Air Transportation” (U.S. Census, n.d.). NAICS “is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy” (U.S. Census Bureau, n.d., para. 1). On the Omega Air website, it is shown that Omega Air has also provided or provides support and/or services to, but not limited to: Royal Air Force, Royal Australian Air Force, Finnish Air Force, Red Flag exercises, and Valiant Shield (Omega Air, 2021).

According to the U.S. Department of Defense (2019), Omega Aerial Refueling Services was awarded \$92,370,920 for modification to a previously awarded firm-fixed-price, cost-type contract. This modification provided for additional aerial refueling services in support of the Department of the Navy, other Department of Defense agencies, and Foreign Military Sales customers during missions ranging from basic training to multi-national exercises. The contracting activity was the Naval Air Systems Command and the additional refueling services were expected to be completed in March 2020.

Furthermore, Omega Aerial Refueling Services was awarded an \$84,200,232 firm-fixed-price, cost reimbursable indefinite-delivery/indefinite-quantity contract in September 2020. This contract provided AAR “probe and drogue” type refueling services to probe-equipped receivers for receiver pilot initial qualifications, recurring

pilot refresher readiness training and supporting fleet exercises for Department of Defense agencies, Department of Navy fleet and test customers, Foreign Military Sales customers and U.S. government contractors. Work will be performed in Riverside, California (55%); Brunswick, Georgia (40%); and various locations outside the continental U.S. (5%). The Naval Air Warfare Center Aircraft Division was named the contracting activity and all refueling services stated in the contract are expected to be completed in September 2022 (Department of Defense, 2020).

Tempus Applied Solutions/Tristar is not known to be performing any contracts. TriStar Air, the subsidiary company of Tempus, was awarded a \$121 million contract with the USN for AAR services. Thereafter, the contract was protested due to specific concerns with the wording of the contract. The USN corrected the contractual issues, canceled the award to TriStar and initiated a new Request for Proposal (RFP). TriStar re-proposed but unfortunately, did not submit the proposal in its entirety by the deadline and their proposal was not considered by the USN. TriStar protested the determination and in December 2020, the U.S. Government Accountability Office (GAO) denied the protest because, even though TriStar submitted their portion of the proposal as the prime contractor, their sub-contractor did not submit their portion of the proposal on time in accordance with (IAW) FAR 52.215-1(c)(3) (Instructions to Offerors) (Armstrong, 2020, p. 1-8).

Military Aerial Refueling Solutions has both a website and LinkedIn page, and according to their LinkedIn page, they are currently developing programs to provide refueling services using a new platform to obtain a 90% availability or higher using either

the new Airbus' A330 MRTT, the KC-46, or KC-390. The KC-390 is a multi-use aircraft manufactured by Embraer and is intended to be used for both refueling and transport.

### **The Process of Third Party Transfers**

A third party transfer (TPT) is a transfer of defense articles, training or technical data from an original authorized recipient to a person or organization. It is the responsibility of a PN to request a transfer through the Department of State. The U.S. government requires PNs who receive U.S. originated defense articles, services, or technical data to obtain consent from the Department of State for the transference, disposal, or change of these articles, services or technical data. "Included are defense articles and technical data obtained through the U.S. government Foreign Military Sales (FMS) Program, Grants (i.e. Military Assistance Program or Excess Defense Article), or Direct Commercial Sales" (Defense Security Cooperation Agency, n.d., para. 1).

A TPT questionnaire must be completed by the country decommissioning their equipment (e.g. aircraft). It is submitted to the U.S. Department of State, Bureau of Political-Military Affairs, Office of Regional Security and Arms Transfers (PM/RSAT) (Department of State, n.d.). "If transfer involves Direct Commercial Sale equipment, the divesting country should contact the Department's Directorate of Defense Trade Controls, Bureau of Political-Military Affairs (PM/DDTC)" (Department of State, n.d., para 1.). "Third party transfers are subject to requirements for Congressional notification under AECA, §3(d) (reference (c)), using guidelines similar to those for AECA, §36(b) (reference (c)) notifications" (Department of State, n.d., para. 1).

If an aircraft is identified as having a demilitarized (DEMIL) requirement, an additional process should be followed IAW DODM 4160.28-M, Volume 3, "Defense

Demilitarization: Procedural Guidance” (Department of Defense, 2018). Once an aircraft has been DEMIL’d and approved for TPT, an approval for ferrying the aircraft into the U.S. must be approved by the FAA, called a “Special Airworthiness Certificate” (Federal Aviation Administration, 2013). TPTs and ferrying is relevant to commercial refueling because PNs are selling or want to sell their tanker aircraft to commercial companies. For example, as stated earlier, the Netherlands, a PN to the United States, sold their aircraft to commercial AAR company Omega Air; and therefore, there are TPT and ferrying requirements for PNs to sell their aircraft to commercial AAR companies.

Demilitarization should be considered as part of the TPT process and is defined as eliminating “functional capabilities and inherent military design features from both serviceable and unserviceable DoD materiel. It is the act of destroying the military offensive or defensive advantages inherent in certain types of equipment or material. DEMIL may include mutilation, scrapping, melting, burning or alteration designed to prevent the further use of this equipment and material for its originally intended military or lethal purpose” (Defense Acquisition University, n.d., para. 3). The following is a list of some applicable guidance, instruction, and contacts for DEMIL: DoDM 4160.28-M; DoDI 5000.02; DAG, Chapter 3-4.3.7; and the Defense Logistics Agency (DLA) DEMIL Coding Management Office (DDCMO).

According to DoDM 4160.28-M, Volume I, Defense Demilitarization: Program Administration, DEMIL waivers may be requested through the DoD DEMIL Program Manager (DDPM). DEMIL waivers can be requested for the following reasons: exchange or sale of the component(s); burial of the component(s); hazardous waste; museum display; or certification or verification of component(s). DEMIL waivers will

not be granted for obsolete components or classified components. If an entity wishes to exchange or sale components, there is a step-by-step process that is laid out in DoDM 4160.28, Volume I, Defense Demilitarization: Program Administration (Department of Defense, 2019). Any PNs who wish to exchange or sell their aircraft and its components through a TPT should use this guidance as these assets have military unique capabilities. For tankers, the boom is considered DEMIL D in DoDM 4160.28 Volume 2, *Defense Demilitarization: Demilitarization Coding*. DEMIL D coded items are required to be destroyed along with its components “to prevent restoration or repair to a useable condition” (Defense Logistics Agency, n.d., para. 6).

### **Foreign Military Sales**

Foreign Military Sales (FMS) is the “U.S. government’s program for transferring defense articles, services, and training to our international partners and international organizations. The FMS program is funded by administrative charges to foreign purchasers and is operated at no cost to U.S. taxpayers. The Defense Security Cooperation Agency (DSCA) administers the FMS program for the Department of Defense (DoD)” (Defense Security Cooperation Agency, n.d., para. 1).

There are approximately 189 countries and international organizations that participate in FMS. Policy and guidance as it relates to FMS management includes, but is not limited to the Security Assistance Management Manual (SAMM) DSCA 5105.38-M, The Management of Security Cooperation, aka the “Green Book”; Arms Export Control Act (AECA); and AFMAN 16-101, “Security Cooperation (SC) and Security Assistance (SA) Management” (SAMM, 2012). FMS may be an option for the USAF as it continues to decommission the KC-10 and as it starts to decommission the KC-135.

There may be countries that would like to purchase the KC-10 or KC-135 in lieu of the KC-46 or Airbus MRTT.

### **Applicable Technical Data**

Technical data is relevant to this study because commercial AAR companies that refuel military aircraft using either commercial or military aircraft will be required to adhere to technical data to ensure safety of flight. Accurate and complete technical data ensures safety of flight and maintenance operations. There are three types of technical data: technical orders/technical manuals, flight manuals, and blueprints.

The technical order (TO) or technical manual (TM) “provides clear and concise instructions for the safe and effective operation and maintenance of centrally-acquired and managed Air Force military systems and end items” (Department of the Air Force, 2018, p. xi). There are multiple TOs that are considered General Aircraft (GA) and Job Guides (JGs). The USAF uses these TOs and “Air Force Policy Directive (AFPD) 20-1/63-1 and Air Force Instruction (AFI) 63-101/20-101, establish policy for integrated lifecycle management of the USAF TO System” (Department of the Air Force, 2018, p. 1-1). Personnel who require access to the TOs for the specific aircraft can obtain them through a system called Enhanced Technical Management System (ETMs). “ETMs functions to acquire, improve, publish, catalog, manage, store, distribute and display the official TOs needed for the safe and effective operation of [US]AF weapon systems and equipment. ETMs connects TO users and TO managers in the operational environment” (Department of the Air Force, 2018, p. 2-1). For FMS PNs, they can use Country Standard Technical Orders (CSTOs). Per AFMAN 16-101, CSTOs USAF TOs are updated to reflect configuration and procedural differences to the USAF TOs that

requires a Letter of Offer and Acceptance (LOA) (similar to a contract) with the USAF to provide those updates (United States Air Force, 2018, p. 133).

Flight manuals (FM), similar to TOs, also provide information to include air refueling procedures, weight and load data, functional check flights, weapon loading, etc. (Department of the Air Force, 2018, p. 3-2). Commercial flight manuals, which KC-46 uses, are developed according to Air Transport Association (ATA) requirements (Department of the Air Force, 2018, 3-8). When flying, a copy of AFI 11-215, Flight Manual Program, are given to pilots and aircrew when going into a flying status (Department of the Air Force, 2018, 5-3).

Blueprints are technical or engineering drawings that are used to depict or represent information about an object (e.g. aircraft, engine, part, etc.).

The following is a list of some applicable guidance and instruction for TOs and FMs that need to be addressed to ensure safety of flight:

- 14 CFR 43.1, Applicability
- AFI 33-360, Publication and Forms Management
- AAFP 11-2, Aircrew Operations
- AAFP 10-9, Lead Command Designation and Responsibilities for Weapon Systems
- AAFP 63-1, Integrated Life Cycle Management
- AFI 21-401, Engineering Drawing, Data Storage, Distribution and Control System
- AFI 21-402, Engineering Drawing System
- AFI 21-403, Acquiring Engineering Data
- AFI 21-404, Acquiring Engineering Data
- AFI 63-1201, Life Cycle Systems Engineering

- AFI 63-101/20-101, Integrated Life Cycle Management
- DoD 5010.12-M, Procedures for the Acquisition and Management of Technical Data
- MIL-PRF-5096, Detail Specification Manuals, Technical – Inspection and Maintenance Requirements; Acceptance and Functional Check Flight Procedures and Checklists; Inspection Work Cards; and Checklists; Preparation of...
- MIL-DTL-7700H, Detail Specification Flight Manual, Performance Data Appendix, Mission Crew Manual, Supplemental Manual, and Abbreviated Flight Crew Checklist
- MIL-STD-38784, DoD Standard Practice for Manuals, Technical: General Style and Format Requirements
- MIL-PRF-38804C, Time Compliance Technical Orders - Preparation
- MIL-PRF-32216A, Performance Specification – Evaluation of Commercial Off-The-Shelf (COTS) Manuals and Preparation of Supplemental Data
- MIL-STD-100G, Department of Defense Standard Practice for Engineering Drawings
- TO 00-5-1, AF Technical Order System
- TO 00-5-3, AF Technical Order Life Cycle Management
- TO 00-5-19, Security Assistance Technical Order Program

TOs and FMs have distribution allowances for them as well and who these documents can be released to (Department of Defense, 2012, p. 1). Depending on the type of manual, it could have a distribution statement of A-F. The following figure depicts the various distribution statements:



Figure 3. *Distribution Statements and Their Corresponding Reasons for Use*



**Defense Technical Information Center, 8725 John J. Kingman Rd.; Ft. Belvoir, VA 22060**  
**Distribution Statements and Their Corresponding Reasons for Use**

DoDI 5230.24, August 23, 2012, Change 3, October 15, 2018

<http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/523024p.pdf>

<b>DISTRIBUTION STATEMENT A.</b> Approved for public release: distribution unlimited.					
<b>DISTRIBUTION STATEMENT B.</b> Distribution authorized to U.S. Government agencies (reason) (date of determination). Other requests for this document shall be referred to (controlling DoD office).					
<b>DISTRIBUTION STATEMENT C.</b> Distribution authorized to U.S. Government agencies and their contractors (reason) (date of determination). Other requests for this document shall be referred to (controlling DoD office).					
<b>DISTRIBUTION STATEMENT D.</b> Distribution authorized to Department of Defense and U.S. DoD contractors only (reason) (date of determination). Other requests for this document shall be referred to (controlling DoD office).					
<b>DISTRIBUTION STATEMENT E.</b> Distribution authorized to DoD Components only (reason) (date of determination). Other requests for this document shall be referred to (controlling DoD office).					
<b>DISTRIBUTION STATEMENT F.</b> Further dissemination only as directed by (controlling office) (date of determination) or higher DoD authority.					

For external users to access a PN TOs and FMs that the USAF manages, or USAF TOs and FMs, they can request access through ETMs (Defense Acquisition University, 2019). However, all data requested to be released within ETMs will have to be approved by that technical authority.

Commercial AAR companies may attempt to request access or updates to the TOs and FMs through the U.S. government in accordance with Department of Defense (DOD) Instruction (DODI) 4151.21, “Public-Private Partnership for Product Support” in support of a U.S. government contract (Department of Defense, 2017). However, under Federal Acquisition Regulation (FAR) Part 9, the ability to obtain this critical information may not be allowed because the contractor has an obligation to bring a technically acceptable proposal without any help from the U.S. government. If the U.S. government helps the contractor and does not extend the same offer to other contractors, it may give an unfair competitive advantage (General Services Administration, n.d.). In addition, in the Office of Management and Budget (OMB) Circular A-76, the U.S. government is not allowed to compete against the OEM or other vendors, suppliers, spare parts manufacturers, etc.

(Executive Office of the President, Office of Management and Budget, 2003).

### **Airworthiness and FAA Requirements for AAR Aircraft**

Both the USAF and USN have their own airworthiness offices for their fleet. Outside of the USAF and USN airworthiness offices, the FAA oversees airworthiness and issues airworthiness directives to the public. “A standard airworthiness certificate (FAA form 8100-2 displayed in the aircraft) is the FAA's official authorization allowing for the operation of type certificated aircraft in the following categories: Normal, Utility, Acrobatic, Commuter, Transport, Manned free balloons, and Special classes” (Federal Aviation Administration, 2015, para. 1). A standard airworthiness certificate will remain valid as long as the aircraft meets its approved type design, meets requirements for a safe operation and maintenance, preventative maintenance, and any changes are adhered to 14 Code of Federal Regulations (CFR) parts 21, 43, and 91. If the USN or USAF contracts AAR commercial companies to perform Public Aircraft operations, responsibility transitions from the FAA to that military branch of service for “airworthiness approval, oversight of the operation, and oversight of maintenance procedures. Responsibility for aircrew qualifications and training and for safety and mishap investigations may also shift to the USAF (see, Title 49, United States Code)” (Department of the Air Force, 2020, p. 5).

One FAA mandate that was issued was for the ADS-B. The FAA published Federal Regulation 14 CFR 91.225 and 14 CFR 91.227 in May 2010. This rule states that effective January 1, 2020, aircraft operating in airspace are required to have an ADS-B system that “includes a certified position source capable of meeting requirements. These regulations set a minimum performance standard for both the ADS-B transmitter

and the position sources integrated with the ADS-B equipment” (Federal Aviation Administration, 2020, para. 7). Both military and commercial aircraft are required to meet the requirements of the mandate.

The FAA has recommended ADS-B for aircrafts due to the FAA’s Advisory Circular 91-85B – “Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum (RVSM) Airspace” and National Policy N 8900.500 “Use of Automatic Dependent Surveillance—Broadcast (ADS-B) Out in Support of Reduced Vertical Separation Minimum (RVSM) Operations” (Federal Aviation Administration, 2019). “RVSM airspace is any airspace or route between flight level (FL) 290 and FL 410 inclusive where aircraft are separated vertically by 1,000 feet” (Federal Aviation Administration, 2021). An aircraft is RVSM-compliant when 1) the aircraft design ensures the aircraft will meet RVSM performance requirements; and 2) the aircraft has been properly maintained on an ongoing basis to conduct such operations (Federal Aviation Administration, 2019, p. 7). Operators who intend to conduct RVSM operations should have ADS-B systems which will be monitored by the FAA (Federal Aviation Administration, 2019, p. 8). “Adding ADS-B Out to a non-RVSM compliant aircraft will not make it an RVSM compliant aircraft, nor will ADS-B Out alone ensure vertical separation from other aircraft” (Federal Aviation Administration, 2019).

Unique to FAA airworthiness for military tanker aircraft, USAF owned commercial derived aircraft are required to meet FAA certification to the maximum extent. For the KC-46, the USAF required Boeing to obtain FAA certification on military unique parts to include the boom, centerline drogue system, and wing aerial refueling pods prior to requesting military certification. The FAA had already certified

the airworthiness for Boeing's 767 commercial passenger aircraft. In December 2017, Boeing was "awarded the amended type certificate for the 767-2C aircraft as the baseline for non-military aircraft for the KC-46" (Government Accountability Office, 2019, p. 9). In September 2018, the FAA certified the design of the KC-46, issuing a supplemental type certificate. This type certificate approved the KC-46's airworthiness and its aerial refueling capabilities.

On FAA's Form 8130-6, Application for U.S. Airworthiness Certificate, version dated June 2020, Part III, C, "Check if records in compliance with 14 CFR 91.417", this requires the FAA's Inspector or Designee to ensure an aircraft's maintenance manuals are accurate and up to date as depicted in the following figure:

Figure 4. *14 CFR 91.417*

**§ 91.417 Maintenance records.**

**(a)** Except for work performed in accordance with §§ 91.411 and 91.413, each registered owner or operator shall keep the following records for the periods specified in paragraph (b) of this section:

**(1)** Records of the maintenance, preventive maintenance, and alteration and records of the 100-hour, annual, progressive, and other required or approved inspections, as appropriate, for each aircraft (including the airframe) and each engine, propeller, rotor, and appliance of an aircraft. The records must include -

- (i)** A description (or reference to data acceptable to the Administrator) of the work performed; and
- (ii)** The date of completion of the work performed; and
- (iii)** The signature, and certificate number of the person approving the aircraft for return to service.

**(2)** Records containing the following information:

- (i)** The total time in service of the airframe, each engine, each propeller, and each rotor.
- (ii)** The current status of life-limited parts of each airframe, engine, propeller, rotor, and appliance.
- (iii)** The time since last overhaul of all items installed on the aircraft which are required to be overhauled on a specified time basis.
- (iv)** The current inspection status of the aircraft, including the time since the last inspection required by the inspection program under which the aircraft and its appliances are maintained.
- (v)** The current status of applicable airworthiness directives (AD) and safety directives including, for each, the method of compliance, the AD or safety directive number and revision date. If the AD or safety directive involves recurring action, the time and date when the next action is required.
- (vi)** Copies of the forms prescribed by § 43.9(d) of this chapter for each major alteration to the airframe and currently installed engines, rotors, propellers, and appliances.

**(b)** The owner or operator shall retain the following records for the periods prescribed:

- (1)** The records specified in paragraph (a)(1) of this section shall be retained until the work is repeated or superseded by other work or for 1 year after the work is performed.

(2) The records specified in paragraph (a)(2) of this section shall be retained and transferred with the aircraft at the time the aircraft is sold.

(3) A list of defects furnished to a registered owner or operator under § 43.11 of this chapter shall be retained until the defects are repaired and the aircraft is approved for return to service.

(c) The owner or operator shall make all maintenance records required to be kept by this section available for inspection by the Administrator or any authorized representative of the National Transportation Safety Board (NTSB). In addition, the owner or operator shall present Form 337 described in paragraph (d) of this section for inspection upon request of any law enforcement officer.

(d) When a fuel tank is installed within the passenger compartment or a baggage compartment pursuant to part 43 of this chapter, a copy of FAA Form 337 shall be kept on board the modified aircraft by the owner or operator.

(Approved by the Office of Management and Budget under control number 2120-0005)

[Doc. No. 18334, 54 FR 34311, Aug. 18, 1989, as amended by Amdt. 91-311, 75 FR 5223, Feb. 1, 2010; Amdt. 91-323, 76 FR 39260, July 6, 2011]

Designee's are called Designated Airworthiness Representatives (DARs). A

DAR is "an individual appointed in accordance with 14 CFR §183.33 who may perform examination, inspection, and testing services necessary to the issuance of certificates.

There are two types of DARs, manufacturing (DAR-F) and maintenance (DAR-T)"

(Federal Aviation Administration, 2021). DARs must accomplish multiple training

requirements to become a DAR. Part IV of Form 8310-6 "Inspection Agency

Verification" ensures the aircraft has been inspected and found airworthy IAW 14 CFR

Part 121 Certificate Holder, Certificated Mechanic, and Certificated Repair Station"

(Federal Aviation Administration, 2019). "Title 49 USC, Section 44705, Air Carrier

Operating Certificates, states "the Administrator of the Federal Aviation Administration

shall issue an air carrier operating certificate to a person desiring to operate as an air

carrier when the Administrator finds, after investigation, that the person properly and

adequately is equipped and able to operate safely under this part and regulations and

standards prescribed under this part" (Cornell Law, n.d.). As part of the USN Solicitation

#N0042120R0094, "the Offeror shall demonstrate its experience in developing

GOPs/FOPs [Ground Operations Procedures/Flight Operations Procedures] as well as

updating those GOPs to perform air vehicle modification and installations within the

scope of contract activities in accordance with DCMA INST 8210.1 or FAA Part 135 or Part 121 with DOD” (SAM.gov, 2020).

A DAR should be objective and the aircraft owner should not have any influence over the DAR’s recommendation for meeting airworthiness of an aircraft. A DAR can be terminated at any time IAW 183.15(b) FAA Order 8110.37F and the DARs are cautioned the appointment is a privilege and not a right. All designees must sign a Designee Acknowledgement of Responsibilities confirming they understand they know what they are responsible for and acknowledgement they can be terminated at any time. DARs must obtain all guidance material to perform their job and stay up to date on all references applicable functions they are performing. An example of a designee acknowledgement of responsibilities is shown in the figures below.

Figure 5. *Designee Acknowledgement of Responsibilities, 1 of 2*

**DESIGNEE ACKNOWLEDGMENT OF RESPONSIBILITIES**

**1.0 Basis and Requirements for Delegation of Authority.**

Title 49, United States Code, is the legislative instrument governing U.S. aviation.

Section 44701(a) states that the Administrator of the FAA “shall promote safe flight of civil aircraft in air commerce...”

To fulfill these responsibilities, the Administrator is provided with various resources, including the power to delegate to others. This power is specified in § 44702(d), Delegation:

“(1) Subject to regulations, supervision, and review the Administrator may prescribe, the Administrator may delegate to a qualified private person, or to an employee under the supervision of that person, a matter related to:

- (a) The examination, testing, and inspection necessary to the issuance of a certificate under this chapter, and
- (b) Issuing the certificate.

(2) The Administrator may rescind a delegation under this subsection at any time for any reason which the Administrator deems appropriate.”

Title 28, United State Code, § 2679, states a designee/delegation is not considered an employee of the U.S. Government and is not federally protected for the work performed or the decisions made by the designee or the ARs.

In addition, Title 14, Code of Federal Regulations, part 1, indicates that where the regulations make reference to the “Administrator,” this also includes any person authorized by the Administrator to exercise or perform that specific power, duty, or function.

**2.0 Authorization and Role of a Designee.**

Order 8100.8 sets out policy, procedures, and conditions under which an applicant may obtain a delegation of authority that may be exercised by a designee.

When accomplishing this task, the designee uses the same standards, procedures, and interpretations applicable to FAA employees accomplishing similar tasks. The designee is also required to observe all conditions and limitations imposed by the Administrator on the authority delegated.

**3.0 Statement of Understanding.**

I understand that an appointment as a representative of the Administrator is a privilege and not a right. I understand that I may be terminated from this appointment at any time for any reason at the discretion of the Administrator.

Figure 6. *Designee Acknowledgement of Responsibilities, 2 of 2*

**4.0 Statement of Acceptance of Responsibilities and Obligations.**

I understand and accept the responsibilities and obligations, as detailed in my letter of authorization, Orders 8100.8 and [specify those that apply], associated with the exercise of the authority delegated by the Administrator.

I understand as a representative of the FAA, I am not an employee of the U.S. Government or federally protected for the work I perform.

As an authorized designee [specify type], I will:

- (a) Function in accordance with the responsibilities, privileges, and limitations contained in the relevant regulations and orders.
- (b) Safeguard all FAA forms, certificates, and other official documents (for example, FAA Forms 8130-1, 8100-1, 8130-6, and 8130-13).
- (c) Perform only those authorized functions called out in my Certificate of Authority or ODAR procedures manual.
- (d) Dedicate the required resources for the effective performance of the delegated functions.
- (e) Remain knowledgeable in the [specify] specialty and in the applicable airworthiness standards, policies, and procedures.
- (f) Attend FAA sponsored training as required.
- (g) Cooperate with the FAA in exercising this delegated authority.
- (h) For manufacturing designees, submit Summary Activity Reports in the timeframe determined by the managing office, as required.

\_\_\_\_\_  
Mr./Ms. J. Doe, DXX-123456-XX

\_\_\_\_\_  
Date

**Liability, Training, and Sustainment Considerations for AAR Companies**

Liability is an issue for commercial AAR companies because they are refueling U.S. government owned aircraft. Having liability insurance is needed and clearly stated



liability requirements should be defined in the contracts between the U.S. government and commercial AAR companies. The following CFR and FAR references are associated with the USN Solicitation #N0042120R0094 as it relates to liability (SAM.gov, 2020):

- 48 CFR 52.228-7, Insurance – Liability to Third Persons – “the Contractor shall provide and maintain workers’ compensation, employer’s liability, comprehensive general liability (bodily injury), comprehensive automobile liability (bodily injury and property damage) insurance, and such other insurance as the Contracting Officer may require under this contract.”
- 48 CFR 52.246-25 – Limitation of Liability—Services – “the Contractor is expressly responsible under this contract for deficiencies in the services required to be performed under it (including any materials furnished in conjunction with those services), the Contractor shall not be liable for loss of or damage to property of the Government that: (1) Occurs after Government acceptance of services performed under this contract; and (2) Results from any defects or deficiencies in the services performed or materials furnished.”
- 48 CFR 52.247-21 – Contractor Liability for Personal Injury and/or Property Damage - “(a) The Contractor assumes responsibility for all damage or injury to persons or property occasioned through the use, maintenance, and operation of the Contractor's vehicles or other equipment by, or the action of, the Contractor or the Contractor's employees and agents. (b) The Contractor, at the Contractor's expense, shall maintain adequate public liability and property damage insurance during the continuance of this contract, insuring the Contractor against all claims for injury or damage. (c) The Contractor shall maintain Workers' Compensation

and other legally required insurance with respect to the Contractor's own employees and agents. (d) The Government shall in no event be liable or responsible for damage or injury to any person or property occasioned through the use, maintenance, or operation of any vehicle or other equipment by, or the action of, the Contractor or the Contractor's employees and agents in performing under this contract, and the Government shall be indemnified and saved harmless against claims for damage or injury in such cases.”

If commercial AAR companies plan on utilizing boom refueling, training is a necessity for safety of flight. Currently, only military personnel are performing boom refueling. According to the USAF website, in-flight refueling requires 8.5 weeks of basic military training and 23 days of technical training. The technical training is held at Lackland Air Force Base, Texas (United States Air Force, n.d.). In addition, there is an in-flight refueling education and training plan that should be followed (Department of the Air Force, 2020).

A U.S. government contractor is required to perform the requirements of a contract in accordance with all applicable laws and regulations according as it states in FAR 52.212-4, “Contract Terms and Conditions-Commercial Items” (General Services Administration, 2021). Other applicable regulations include 48 CFR 52.247-21, “Contractor Liability for Personal Injury and/or Property Damage” (Cornell Law, n.d.), and 52.246-23, “Limitation of Liability” (“52.246-23, Limitation of Liability,” n.d.).

The responsible party for collisions, damage to the aircraft, or other mishaps during AAR missions would be defined in the U.S. government’s contract between that branch of service and the contractor. The CFR and FAR, along with the contract

documents, like the Performance Work Statement (PWS), “which is a Statement of Work (SOW) for Performance-Based Acquisitions that clearly describes the performance objectives and standards that are expected of the contractor. When a contract is awarded, the PWS is legally binding upon the contractor and the U.S. government” should describe these liabilities (AcqNotes, 2021).

For example, in the USN’s Solicitation #N0042120R0094, titled “Contracted Air Services (CAS) Air to Air Refueling (AAR) Services”, the original PWS, published August 30, 2019 stated, “the Contractor shall be responsible for all accidents and damage to its aircraft that occurs during operation of the aircraft. The Contractor shall bear all costs to repair or replace aircraft parts and all additional ferry costs or travel costs that occur as a result of the accident or damage” (SAM.gov, 2020).

A second and amended PWS, published on June 11, 2020 under the same solicitation stated, “The contractor shall be responsible and liable for any damage, caused by the contractor, to any government furnished equipment, aircraft, assets, or property that is directly attributed to the contractor’s negligence, failure to follow approved procedures, or failure to follow Federal Statutes, FAA regulation, or any required Department of Navy procedures” (SAM.gov, 2020).

An industry questions and answer (Q&A) document was published on July 16, 2020 under the same solicitation and included the following question from one of the Offerors: “As written, PWS paragraph 3.4.10 makes the contractor responsible for all costs independent on whether the contractor is responsible for an accident or damage or another entity is responsible. Would the government consider modifying this paragraph?” A response from the U.S. government was as follows, “Amendment 0001

revised the language the language in PWS paragraph 3.4.10” (SAM.gov, 2020). The amended PWS was later published under the same solicitation and states, “The contractor shall be responsible and liable for any damage, caused by the contractor, to any government furnished equipment, aircraft, assets, or property that is directly attributed to the contractor’s negligence, failure to follow approved procedures, or failure to follow Federal Statutes, FAA regulation, or any required Department of Navy (DoN) procedures” (SAM.gov, 2020).

Training is necessary to ensure appropriate personnel are not only operating and flying an aircraft safely; but for commercial AAR companies desiring to perform boom refueling, additional training should be completed by company personnel. In addition, to sustain an aircraft throughout the period of performance of an AAR contract, having the ability to procure parts is necessary. Without needed parts, the aircraft cannot fly. Even the need for one small part can ground one aircraft or an entire fleet.

The obsolescence of aircraft parts is something commercial AAR companies must consider when sustaining aircraft long-term. Diminishing Manufacturing Sources and Material Shortages (DMSMS) is the loss of resources and material needed to build, maintain and operate warfighting equipment. DMSMS may endanger the life-cycle support and viability of the weapon system or equipment. It’s defined by the DoD as “...loss or impending loss of the last known manufacturer or supplier of raw material, production parts, or repair parts, and by industry as the ...loss or impending loss of the original manufacturer or supplier of raw material, production parts or repair parts. An obsolete device is part of a larger system that is no longer manufactured by the original manufacturer” (Defense Acquisition University, 2020, para. 2). DMSMS is a major

hindrance to keep aircraft operational. The U.S. government and its contractors have tried to address DMSMS issues early in the acquisition process, but with technology changing so quickly, it's hard to keep up. The need to purchase/obtain data rights in order for the U.S. government to posture themselves for long-term sustainment is key (Department of Defense, 2021).

One way to plan for obsolescence issues is for the U.S. government and/or contractors to write a DMSMS plan that addresses all parts within the Bill of Materials (BOM) and Illustrated Parts Breakdown (IPB) for the particular effort (repair, modification, new procurement, etc.). There is a multitude of resources that will help U.S. government personnel and contractors work together to address DMSMS in their plan. These resources include:

- Defense Acquisition University knowledge sharing and courses
- Diminishing Manufacturers Sources and Material Shortages: A Guidebook of Best Practices for Implementing a Robust DMSMS Program
- Defense Acquisition Guidebook (DAG), Diminishing Manufacturers Sources Material Shortages
- DoD DMSMS working groups
- DoDI 4245.15, "Diminishing Manufacturers Sources Material Shortages Management"
- DoDI 5000.02, "Obsolete Parts"
- Parts and Material Management Conference
- Trade Journals and Studies

## CHAPTER III

### METHODOLOGY

The purpose of this study was to analyze current military and commercial AAR capabilities, technical and training requirements, liabilities, procurement of parts, as well as obsolescence of those parts, and overall sustainment impediments for commercial AAR companies wanting to or performing AAR for all branches of U.S. military service. This study examined a sample of aviation professionals knowledgeable in air-to-air refueling operations. The researcher believes that the perspective provided by the professionals was critical in gaining a better understanding if commercial refueling is a benefit to the NDS; whether its services are used for training exercises, testing aircraft, or other requirements from both the military and private sector entities. The researcher developed the following research questions to align with the intent of this research study:

RQ1: In 2021, there are 400+ U.S. military tankers in service. With this many U.S. taxpayer-funded military tankers currently in service, why is the USN already utilizing commercial AAR services and the USAF is seriously considering it?

RQ2: Regarding refueling collisions, damage to the aircraft, or other mishaps during AAR missions, will the commercial refueling companies be responsible for all collateral damage to U.S. military aircraft and aircrews?

RQ3: How will the U.S. government ensure the commercial refueling companies properly operate and maintain their aircraft during the contract period of performance?

RQ4: How will the commercial refueling companies properly obtain approval for receiving and operating approval for boom-equipped aircraft purchased from partner nations?

For the purpose of organization, this chapter discusses the research method, research participants, research instrument, data collection, timeline for conducting the study, data collection, validity and reliability of the study, and ethical issues and assurances.

### **Research Method**

The principles that guided the method of the study were through phenomenological research. Phenomenological research was used because of the commonality between research participants who have first-hand knowledge of AAR. The methodology involved in-depth interviews based on personal and professional knowledge and emphasized the importance of the research participant's perspective and interpretation of the problem. This in turn, permitted the findings of the data to be used for practical applications, as well as for informing and supporting efforts to determine if commercial AAR should be considered as part of the NDS.

The underlining goal was to provide the opportunity for the research participants' voices to be heard and bring their individualized experiences, as well as their concerns to the surface. The data collected provided insight using a phenomenological approach by dividing the procedures into statements, then transforming them into common meanings,

and finally tying the results together, making a general description of the experience (Moustakas, 1994). Using this methodology, research questions were developed to specifically explore the meaning of the research participants' experiences (Creswell, 2007). This approach to gathering data was appropriate due to the nature of the study and the precise documentation required to better understand if commercial AAR could be potentially benefit to the NDS.

### **Research Participants**

Exploratory in nature, this research study was designed to identify demographic information from 25 U.S. government and contractor organizations, as well as their perceptions related to commercial AAR. These 25 organizations were identified through general internet and trade journal searches using search terms such as “commercial air-to-air refueling”, “Navy refueling”, “Air Force refueling”, or “air-to-air refueling”. Nine organizations and associated personnel (both employed and retired) made the determination to participate in this study. The nine participating organizations included: (1) two branches of U.S. military service, (2) one U.S. government agency, (3) one professional organization, (4) one U.S. government contractor, (5) one commercial AAR company, and (6) three organizations who did not identify themselves. Specific contacts within these organizations were identified through internet searches or telephone calls made by the researcher. These organizations and personnel are considered a stakeholder as it relates to commercial AAR.

Due to commercial AAR being a highly visible and political topic for the Senate Armed Services Committee, USAF, and other key stakeholders, most of the research participants requested to remain anonymous. The professional expertise of the research



participants include prior tanker aircrew and maintenance members, policy and legal experts, avionics, supply chain, and airframe knowledge, as well as international aviation processes.

### **Research Instruments**

Two separate and distinct surveys were sent to the research participants. The surveys were developed based on concerns over the overall operations and sustainment of tanker aircraft. One survey was sent to U.S. government agencies, military branches of service, and the private sector to better understand exact fleet size, future fleet size, and mission requirements (Appendix B). The other survey was sent to commercial AAR companies to gain their perspective on how can sustain and operate the fleet of aircraft they own to perform AAR requirements (Appendix C). Each survey consisted of three sections: (1) demographic information, (2) questions requiring detailed responses, and (3) a text box for comments.

The demographic information included: (1) age of the research participant and (2) the highest degree or level of school completed by the research participant. The second section listed a series of open-ended questions requiring an inputted response from the participant. These questions were intended to gain insight into the research participants' perceptions and understanding of commercial AAR as well as operations and sustainment of AAR aircraft. Open-ended questions included in the survey sent to U.S. government agencies, military branches of service, and the private sector included:

IQ1: What is your current fleet size, future fleet size, and/or mission requirements related to commercial air-to-air refueling?

- IQ2: What is the purpose for utilizing commercial refueling companies in lieu of military tankers?
- IQ3: What are your thoughts on U.S taxpayers paying for commercial refueling when there are military utilized for refueling purposes?
- IQ4: Federal Aviation Administration (FAA) commercial aircraft pilot qualifications require specific flight hours, flight training (emergency recovery), and type model certification. How will commercial AAR aircraft pilots meet these FAA regulatory requirements for pilot certification and type model certification on a military aircraft that was previous excluded from these FAA requirements?
- IQ5: Military aircrew positions have regulations and training doctrine for successfully attaining and maintaining a qualified status. How will commercial AAR companies meet similar continual training requirements?
- IQ6: How will the commercial AAR fleet maintain AAR certifications required for military aircraft operations?
- IQ7: What is the process for obtaining boom operation approval for the commercial AAR companies?
- IQ8: How will commercial AAR companies meet FAA requirements (e.g. ADS-B, Mode 5, etc.)?
- IQ9: What is your ten-year plan for AAR services, whether it is military or commercial AAR?
- IQ10: Who is liable for mishaps or crashes that may occur while a contractor performs AAR services?

Open-ended questions included in the survey sent to the commercial AAR companies included:

- IQ1: What is your process to sustain an aging fleet to support your AAR customers (maintenance, repair, overhaul, etc.)?
- IQ2: Specifically, what are you doing to address obtaining parts and obsolescence issues, known as Diminishing Manufacturers Sources Material Shortages (DMSMS)?
- IQ3: How do you obtain the necessary technical data (e.g. technical orders/maintenance manuals, flight manuals) in order to operate your fleet?
- IQ4: Federal Aviation Administration (FAA) commercial aircraft pilot qualifications require a specific number flight hours, flight training (emergency recovery), and type model certification. How will your civilian AAR aircraft pilots meet these FAA regulatory requirements for pilot certification and type model certification on a military aircraft that was previous excluded from these FAA requirements?
- IQ5: Military aircrew positions have regulations and training doctrine for successfully attaining and maintaining a qualified status. How will your aircrews meet similar continual training requirements?
- IQ6: How will your fleet maintain AAR certifications for operating with military aircraft?
- IQ7: What has been your process for obtaining boom operation approval?
- IQ8: Does your aircraft currently meet FAA requirements (e.g. ADS-B, Mode 5, etc.) and if not, what are your plans for meeting them while maintaining the aircrafts' Air Refueling Airworthiness Certification?

IQ9: As the commercial AAR contractor, who is liable for mishaps or crashes that may occur while performing AAR services?

IQ10: Why do you think the government uses commercial AAR in lieu of military tankers?

IQ11: Where is your aircraft operations?

The third section of the survey provided a text box offering the research participants an opportunity to provide personal and/or professional comments regarding commercial AAR. Interviews were conducted with research participants to obtain clarification to their responses to the survey.

### **Data Collection**

The surveys developed for this study were distributed via email to the 25 U.S. government and contractor organizations using the third party Qualtrics survey tool. Qualtrics is a web-based survey tool which provides an extensive amount of data and metrics associated with the research instrument (Qualtrics, 2021). Potential research participants were asked to complete the survey using a secure link from Qualtrics. Qualtrics is designed to protect research participants' responses and is a trusted and encrypted research platform. The researcher was the only person who had access to the encrypted Qualtrics website specific to this study.

The researcher received two completed Qualtrics surveys. Five additional surveys were submitted to the researcher's personal student email as an email attachment. These surveys were completed by research participants who did not have access to the Qualtrics link due to U.S. governmental email restrictions; or they chose not to use Qualtrics. Lastly, two additional research participants did not complete the survey, but

did provide the necessary data to the researcher through email discussions and telephone interviews which were transcribed.

### **Timeline for Conducting the Study**

The initial contact with potential research participants with the intent of completing a survey, answering questions from research participants, conducting interviews, and data analysis took the researcher three months and was completed by June 2021.

### **Data Analysis**

The data analysis for this study was a multi-step process consisting of detailed survey responses, emails, and telephone interviews from subject matter experts from across the U.S. and outside the continental U.S. The researcher manually coded the responses from the completed surveys, as well as manually coded and compared all of the participants' responses from the telephone interviews in order to identify commonality among responses. Next, the researcher clustered all of the participants' responses into common themes (Creswell & Creswell, 2018). The participants' responses to each interview question were put into a corresponding research question response table (Tables 3-6) (Chapter IV) and the common themes for each research questions were included after each table. From the data collected and the analysis of the data, conclusions and recommendations were identified (Chapter V) as it relates to commercial AAR.

### **Validity and Credibility of the Study**

With qualitative research, validity and credibility of this research related to commercial AAR and military tanker refueling is important because the findings may be

used as a springboard for future studies and reports as it relates to commercial AAR and military tanker refueling. Validity in research addresses concerns of whether the research provides definitive answers to questions. The researcher: (1) used academic and aviation/aerospace experts to validate the research instrument before it was submitted to the participants, (2) used historical analysis (review of the literature), (3) used data from different sources including interviews with subject matter experts to assess the similarities and consistencies across the industry, and (4) used consistency of interview data among participants interviewed as well as consistency for the same participant. In this research study, participants' responses were mostly qualitative and a triangulation of data showed some responses were similar to each other.

Triangulation refers to the use of multiple methods and data sources in the study of the same phenomenon (Strauss and Cobin, 1998). The process of the triangulation of data strengthens the research study by increasing the overall validity and credibility of the data sets and information used by the researcher (Sarantakos, 1998). In addition, to overcome the potential bias resulting from the use of a single method or single source of data in a study, valid triangulation plays an important role in this area by increasing the rate of certainty and bringing neutrality. The benefits of triangulation include “increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem” (Thurmond, 2001, p. 254). The researcher used triangulation by grouping similar responses to the questionnaire, and providing conclusions (Chapter V) based on those responses.

Last, triangulation used in this way deepens the researchers' understanding of the issues and maximized the researcher's confidence in the findings of this study. By enhancing the validity of the study, results through triangulation ensured that this research study is worthy of a contribution to the existing body of knowledge regarding commercial AAR and its consideration as part of the National Defense Strategy.

### **Ethical Issues and Assurances**

Human subjects were an integral part of this study; therefore, this research study was conducted in accordance with Institutional Review Board (IRB) requirements established by the Oklahoma State University (OSU) Office of University Research Compliance (URC). The researcher obtained IRB approval on March 18, 2021 and the study was filed as IRB-21-136 (Appendix E). The researcher did not begin collection of data before obtaining IRB approval.

An informed consent letter was emailed to each research participant to review prior to choosing to participate in the study. The consent letter clearly stated the purpose of the study and the rights of the employees to participate on a voluntary basis. In addition, the letter included information regarding the researcher, purpose for collecting the information from the employee, confidentiality of responses and measures taken to ensure anonymity, risks and benefits to research participants, and contact information of the researcher, faculty advisor, and IRB. The consent letter is located in Appendix D.

## CHAPTER IV

### RESEARCH FINDINGS

The findings of the research study were analyzed to determine if commercial air-to-air refueling activity is beneficial to the National Defense Strategy; regardless if their refueling services are used for training exercises, testing aircraft, or other requirements from both the military and private sector entities.

#### Demographic Questions

The first demographic question from both research surveys asked the research participants their age. Table 1 shows that half (50%) of the research participants (n=6) were 65 years of age or older. Three of the research participants chose not to answer this demographic question.

Table 1  
*Age of Research Participant*

Age of Research Participant	Responses	Percentage of Responses
18-24	0 out of 6	0%
25-34	0 out of 6	0%
35-44	1 out of 6	17%
45-54	1 out of 6	17%
55-64	1 out of 6	17%
65 or older	3 out of 6	50%



The second and last demographic question from both surveys asked the research participants their highest academic completion. Of the seven research participants that elected to answer this question, four had earned a Master’s degree and the remaining three had earned a doctorate or professional degree (Table 2). Two of the research participants chose not to answer this demographic question.

Table 2  
*Academic Completion of Research Participant*

Degree or Level of School	Responses	Percentage of Responses
High School Diploma or GED	0 out of 7	0%
Some College Credit, No Degree	0 out of 7	0%
Associate Degree	0 out of 7	0%
Bachelor’s Degree	0 out of 7	0%
Master’s Degree	4 out of 7	57%
Doctorate or Professional Degree	3 out of 7	43%

### **Interview Questions**

In addition to the two demographic questions, this study was designed using a series of interview questions (IQs), which highlighted each research participant’s expert opinion to answer the four research questions initially stated in chapter I. Two separate and distinct surveys, including the interview questions, were sent to the research participants. One survey was sent to U.S. government agencies, military branches of service, and the private sector (Appendix B); and the other survey was sent to commercial AAR companies (Appendix C).

In addition, both surveys requested research participants to provide personal comments (last section of the surveys). Personal comments were incorporated where appropriate as they relate to each research question. No responses were provided to IQ11 – commercial AAR companies.

## Research Participant Responses - Research Question 1 (RQ1)

The first research question sought to determine why the USN was already utilizing commercial AAR services and why the USAF was considering it. Interview questions IQ2 and IQ3 - U.S. government agencies, military branches of service, and the private sector; and IQ10 – commercial AAR companies served to answer RQ1 and the research participants’ responses are presented in Table 3.

Table 3  
*Research Participant Responses to RQ1*

Research Participant	Research Participant Response
Participant A	Filling the gaps for lower priority requirements. Commercial Aerial refueling has the ability to fill gaps in capacity to support training, exercise and Test and Evaluation (T&E) requirements and preserves life on combat aircraft. Currently, the Department of the Navy has requirements for military and commercial AAR scheduled for the next ten years.
Participant B	In theory, to increase capacity for training and non-combat operations. However, commercial AAR is a notion designed to augment a refueling technique devised seven decades ago. While leveraging contractor support in military operations can be useful as a temporary measure, the significant outlays required for commercial AAR dictate that we should be considering more enduring solutions like increasing range, alternative fuels, alternative methods, etc. I do not think commercial AAR is tenable or desirable.
Participant C	When properly maximizing commercial efficiencies with meeting military expertise, the customer can meet their aerial refueling requirements at a fraction of the cost and with better reliability of using military tankers operated and maintained on a military-only philosophy. The contracted customers can receive better dedicated support, no matter the priority of the mission. There is no need for infrastructure or logistics support manpower by the customer as this can be provided through the aerial refueling support services contract. With commercial aerial refueling services available, the warfighter in their military tanker can focus on the variety of direct and indirect war-time aerial refueling missions. This would allow the lower-priority, but still very important, support missions to be conducted by commercial aerial refueling operators. Some of these missions could include readiness training, test and evaluation], receiver qualification, aircraft delivery or oceanic transit, Foreign Military Sales, various

exercises, and routine receiver training missions. Commercial AAR can be an excellent surge suppressor to absorb spikes in AAR requirements around the world by performing the more routine AAR that never stops such as pre-deployment training, exercise support, schoolhouse training, CORONET aircraft deliveries, and routine training. Therefore, with commercial aerial refueling services available, the warfighter in their military tankers can focus on the variety of direct and indirect wartime aerial refueling missions. While they can focus on those critical tasks, the more lower-priority and routine, but absolutely critical training, readiness, test and evaluation, aircraft delivery, FMS support and other missions can receive all the necessary support they have been lacking for many years. As the USAF and USTRANSCOM struggle to create and implement a viable commercial aerial refueling support services contract, the biggest hurdle I see is that the military teams that have been tasked to take on this challenge all come from a background of knowing how “military” tankers operate along with some knowledge of how commercial airlift works (which is very different than commercial aerial refueling). They lack the in-depth understanding of what commercial efficiencies can be maximized when a proper AAR services contract is offered. The commercial AAR business has been honed for more than 20 years with tremendous success. Another serious flaw to this program development has been that instead of establishing basic requirements and allowing industry to use innovation and ingenuity to meet those requirements, the USAF seems intent in determining the best business case and methods for a commercial company to meet these requirements. Instead of saying they want a mousetrap to catch x number of mice of a certain size and shape, they are attempting to tell industry how to design this new mouse trap, how to build it, how to certify it, how to train people to operate it and how to best implement its use. All of this written with limited understanding of the commercial benefits and efficiencies that can be maximized under the proper contract. When following this solicitation model, a successful aerial refueling services solicitation would result a commercial tanker fleet that is no more efficient than those being operated and maintained by military aircrews. In fact, due to the small size of the commercial fleet, additional complications with civilian and military airworthiness authorities, and misguided priorities, it would most likely result in higher costs, lower efficiencies and a failed project in just a few years. The commercial innovation this country thrives on is 100% lost when the Government dictates the solution as part of the requirement. If commercial efficiencies, innovative creativity, and unfiltered problem solving is all combined with a thorough understanding of military requirements, the result could be a mouse trap that is 200% or more efficient and more readily available. Why not let industry do what industry does

	<p>best, solve challenges? This all leads to the driving question. What is the requirement? How much aerial refueling does the military require? As simple as that question seems, defining the aerial refueling shortfall is a slippery slope. Is the requirement based on what is currently being asked for by the receivers? What if receiver units quit asking for support because they have been told “No, your priority is not high enough!” for so long it becomes a waste of valuable time to even ask the question again. Does this mean they don’t have a requirement anymore? The aerial refueling requirements would be more accurately determined by assessing the various receiver units, not by having the tanker-providers assess what they believe their customers want or need.</p>
Participant D	<p>To make up for capability gaps created by ongoing KC-135 and KC-10 retirements and for delays in achieving operational capability with the KC-46. However, commercial AAR should only be performance-based contracts for specific mission sets.</p>
Participant E	<p>With the drawdown and retirement of aging aircraft that have become expensive to maintain, as well as the delays of getting replacement tankers like the KC-46 to an operational state, there are insufficient booms in the air to support both operational and training missions. Commercial AAR seems like an effective way to sustain those operations in a continuing drawdown of funding for military tankers and support. Similar to contracted labor, commercial contracts for this support could be turned off and turned on as the need arises. We can assist with their [commercial AAR companies] maintenance, repair, and logistics needs, as well as potential upgrades to the aircraft. The level of effort would depend on the number of aircraft in their fleet.</p>
Participant F	<p>No response</p>
Participant G	<p>No response</p>
Participant H	<p>I do not think a supportable argument can be made which sufficiently reduces the risk of non-performance by a commercial refueling provider to combat operations.</p>
Participant I	<p>Unless the Assistant Secretary of the Air Force for Acquisition has determined otherwise in very recent days, the USAF has no validated need, purpose or requirement to supplement its aerial refueling capacity through the use of contractors. Per recent knowledge, the USAF has no validated need for a contract for contractors to provide their own tankers or to perform air-to-air refueling (AAR) for the USAF. Based on annual Defense appropriations and authorizations, the USAF tanker fleet is sized to support exactly the needed number of aerial refueling aircraft and personnel without any augmentation by contractors. Rather than paying contractors to acquire, preserve and fly boom-equipped tankers while waiting for the KC-46 to come on line, Congress postponed retirement of the legacy fleet through 2024. The retained legacy tankers with their related crew,</p>

	<p>maintenance, facilities and budget, are more than enough to satisfy the anecdotes about the perceived number of hours that might potentially be needed while waiting for the KC-46 deliveries. In the meantime, the United States Air Force (USAF) leadership was unable to validate any USAF unit that reported an actual shortfall of flying hours. Instead, the only perceived shortfall was anecdotally ascribed to the Navy for U.S. Marine Corps training. To fill that need, the Navy awarded two contracts using aircraft outfitted with “hose and drogue” equipment that mates with Marine Corps (but not USAF) receiver aircraft. In conclusion, there is no validated purpose or need to use contractors to perform aerial refueling for USAF military receiver aircraft. Unless Congress changes the plan in future legislation, the USAF will use military AAR only. Hiring contractors to perform a core USAF military mission such as air-to-air refueling is a really bad idea. Why? 1. Estimates that asserted contractor flying hour expenses on a day-to-day basis could be less expensive than USAF performance did not take into account all of the start-up costs contractors will incur. 2. In the near-term, contractors will compete against the USAF to employ the existing pool of trained, certified personnel. Potentially, contractors could drain the pool of personnel and cause an unintended shortfall of qualified crew and boom operators. 3. Long-term, opening up a commercial industry for worldwide service could disrupt relations with our allies and could create opportunities for our enemies if contractors are allowed to sell aerial refueling services directly to customers other than the United States. 4. Boom-equipped tankers are subject to the Arms Export Control Act and must be demilitarized (destroyed) when no longer used for a U.S. Government contract. This legal requirement was not fully understood in prior studies of contract AAR. If contractors come to understand this requirement, they may no longer be enthusiastic.</p>
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Common themes that emerged from participant responses to RQ1: (1) commercial AAR would provide a capability gap when USAF tankers were not available to fulfill lower priority (training) aerial refueling services; and (2) commercial AAR should not be used in combat-specific settings.

**Research Participant Responses - Research Question 2 (RQ2)**

The second research question sought to determine if commercial refueling companies would be responsible for all collateral damage to U.S. military aircraft and aircrews. Interview questions IQ10 - U.S. government agencies, military branches of

service, and the private sector; and IQ9 – commercial AAR companies served to answer RQ2 and the research participants’ responses are presented in Table 4.

Table 4  
*Research Participant Responses to RQ2*

Research Participant	Research Participant Response
Participant A	Who is liable is dependent on who is at fault.
Participant B	That would depend on the findings of the mishap investigation, which would be conducted jointly with the DoD and FAA.
Participant C	It is determined by the mutually agreed upon AAR support contract. There is no reason to deviate from current Federal Acquisition Regulation (FAR) guidance on insurance requirements for contracted services. We have several different applicable clauses as it relates to liability. FAR 52-228-5 discusses insurance for work on a government installation. FAR 52.228-7 is applicable to Third Person Liability – Services. Just like any other services contract, the [United States Government] USG should tell the contractor how much liability they are responsible to cover in their contract.
Participant D	The contracted company. The USG does not indemnify IAW Public Law (PL) 85-804. PL 85-804 states the U.S. President can authorize any U.S. department or agency that exercises functions in connection with the national defense to enter into contracts or into modifications of contracts whenever he deems that such action would facilitate the national defense. If commercial insurance is too expensive, the contractor can use the FAA War Risk insurance policy similar to what the Civilian Reserve Air Fleet (CRAF) airlines do when activated. The FAA can offer war risk insurance to commercial AAR companies with no premium to the commercial AAR company that has a contract with a branch of service to perform commercial AAR. In order to obtain the insurance, the branch of service or agency would have to request it to support commercial AAR contracts and agree to an indemnification against all losses covered by the insurance.
Participant E	We are only providing support for their (commercial AAR companies) operations, and training for maintenance and systems knowledge/proficiency. I cannot speak to how the operating company will insure safe operations, nor the level of insurance that may be necessary in case of mishaps or crashes.
Participant F	If commercial AAR companies cannot obtain insurance or cannot find insurance at a reasonable price, non-premium war risk insurance can be obtained through the aviation insurance program at the FAA. Insurance can be provided up to one year, but if there is a multi-year contract with the USG, insurance can be requested every year until

	<p>the end of the period of performance. While there is no premium for the insurance, a fee is charged based off how many aircraft are insured. For example, if the contractor adds aircraft from the first year to the second year, a fee will be added to each additional aircraft needing insured. The FAA has not insured refueling missions and the USG self-insuring could provide a cost benefit to the overall contract. In one instance, the USG saved approximately 30% self-insuring vice the contractor obtaining private insurance and passing those costs onto the USG. While the non-premium war risk insurance may seem like it can only be used for wartime use, policy is broad enough to allow for the insurance to be utilized outside of wartime activities. If the aircraft is considered a state aircraft when it is under contract, then we don't have the authority as of now to insure it. If it is a civilian aircraft and remains a civilian aircraft under a civil aviation authority (US or Non-US) then we have the authority. Navy will probably have to request insurance through USTRANSCOM. From what I understand, they are [the] delegated authority to request insurance for the Department of Defense.</p>
Participant G	No response.
Participant H	No response.
Participant I	<p>Short answer: In the absence of a strongly drafted contract clause to the contrary (which does not exist in any contract to date and which is highly unlikely due to the lack of insurance), the United States is liable for all mishaps or crashes, including loss of or damage to the contractor's aircraft and Government property and injury to or death of contractor employees and third parties (including military members in the receiver aircraft), subject to certain very small exceptions discussed below. Ordinarily, under the Federal Tort Claims Act (FTCA) and Military Claims Act (MCA), military members (e.g., in the tanker or the receiver aircraft) cannot recover damages in claims against the military. When the tanker is operated by contractor personnel, however, military members (e.g., in the receiver aircraft) can recover against the contractor, who then seeks reimbursement from the Government under the contract clauses. Government officials should carefully review and understand all of the insurance policy's terms, conditions, exclusions and exceptions before awarding a contract.</p>

There were two common themes that emerged from participant responses to RQ2:

- (1) negligence and responsibility for commercial AAR mishaps or crashes would be determined by the outcome of the accident investigation; and
- (2) contractual agreements

and liability insurance requirements regarding commercial AAR need to be further defined by the U.S. government, including the FAA.

**Research Participant Responses - Research Question 3 (RQ3)**

The third research question sought to determine how the U.S. government will ensure the commercial refueling companies properly operate and maintain their aircraft during the contract period of performance. Interview questions IQ4, IQ5, IQ6 and IQ8 - U.S. government agencies, military branches of service, and the private sector; and IQ1, IQ2, IQ3, IQ4, IQ5, IQ6 and IQ8 – commercial AAR companies served to answer RQ3 and the research participants’ responses are presented in Table 5.

Table 5  
*Research Participant Responses to RQ3*

Research Participant	Research Participant Response
Participant A	Commercial air-to-air refueling aircrew meet equivalent or higher qualifications in accordance with contracts and contract referenced requirements, e.g. 14 CFR, DCMA Inst 8210.1C, NATOPs.... This is common across Contracted Air Services (CAS) for Contractor Owned Contractor Operated (COCO) aircraft that do not have commercial type certificates. Reference the Combat Air Forces Contracted Air Support (CAF CAS) contracts with former military aircraft (e.g. F-5s, Mirages...). Commercial AAR companies, like other CAS companies, meet training requirements with their approved training programs and through the use former and/or military reserve (e.g. USAFR and Air National Guard) aircrew. Commercial AAR fleet maintain their certifications required for military aircraft operations [using JAPCC SDR publications]. Commercial AAR, like all CAS companies currently meet FAA requirements in the same way as all civil and military aircraft.
Participant B	The FAA would have to adopt specific requirements to address commercial AAR. Commercial AAR companies would need to be certified by the same standardization and evaluation authority that certifies military training doctrine and regulations (e.g. USAF AMC).
Participant C	[Obsolescence] If a part or component is truly reaching obsolescence, then we look at upgrading that part or component. If it is simply a lack of vendors, then we can look at a number of other solutions to develop a reliable supply chain. [Obtaining Technical Data] We use



	<p>OEM TOs/manuals from various sources and we can also develop our own, if necessary, for approval. [Meeting FAA Requirements] Unless the FAA changes its regulations and fully recognize all aspects of a transport size, military type certified aircraft, including its operations, on-going maintenance, parts supply, and acceptable engineering changes, it seems unlikely that the FAA would find a reasonable way to accept the pilot certification without a significant amount of effort. The use of Civil Type Certificated aircraft is the easiest path to success based on current regulations. Use of Military Type Certified, large transport category aircraft forces the military to take on the daunting tasks of maintaining the airworthiness of a very small fleet. Even if the FAA did somehow begin to accept all of the necessary military data, there is also the concern about ICAO and other CAAs in other countries accepting the airworthiness of the aircraft, its parts and modifications that have been utilized and the aircrew and maintenance training and currency requirements. However, there is no reason to limit a commercial tanker fleet to using former military aircraft that were excluded from FAA oversight. [Meeting ADS-B, Mode 5, etc.] If using 100% military certified aircraft, then the military must approve the engineering and installation in a manner that meets FAA requirements. The military would have to invest resources to supporting this task. If using Civil Type Certificated, FAA approved aircraft, the FAA STCs or DERs can be used to ensure engineering that is in compliance with FAA requirements and FAA 337s can be used to make sure the installations are in accordance with FAA requirements. One process puts the burden all on the military, the other uses FAA resources to the maximum extent possible to reduce military workload. [Meet Training Requirements] Obtain agreement with the customer about those regulations and training requirements that are applicable and how often they are required and then accomplish them.</p>
Participant D	<p>Meeting FAA requirements is not required since the aircraft will not have a standard airworthiness certificate from the FAA. The government contract will stipulate training requirements similar to the USAF crew position. The commercial AAR companies probably will inherit existing ARCA certifications and will need to meet the criteria established by AFLCMC/EZ (ARCA) that is required for the level of clearance required for assigned mission set. Aircraft would either be compliant at time of GFE [Government Furnished Equipment] transfer or approval. If commercial owned, that would be their investment in order to meet contract criteria.</p>
Participant E	<p>[Obsolescence] We would determine whether a repair capability exists or if one could be established for repairable components, while also researching the availability of legacy parts in the industry aftermarket. For certain parts with upgrades that are available, we would propose the upgraded components for their consideration.</p>

	<p>[Obtaining Technical Data] As the OEM for the Avionics system, the technical orders, maintenance manuals, and flight manuals are derived from technical data that we have proved, or in some cases, we are the writer/publisher of the manuals. [Meeting FAA Requirements] We are only providing support for operations by a commercial company/operator of the aircraft and not flying them; however, I believe our customer could seek an experimental or provisional flight certification in order to operate the aircraft. [Meet Training Requirements] We are only providing support for their operations, and training for maintenance and systems knowledge/proficiency. I cannot speak to how the operating company will keep their aircrews current on the aircraft platform. I cannot speak to how the operating company will maintain AAR certifications. [Meet ADS-B, Mode 5, etc.] The support contract includes consulting efforts to research and determine potential upgrades to the aircraft in order to meet those requirements, as well as potential future requirements.</p>
Participant F	No response.
Participant G	<p>Any of these types of operations that I am aware of have been done as public aircraft operations (PAO) (not commercial in the FAA sense of the word). The flight crew and their crew qualifications are up to the contracting service and the liability for those types of operations when declaring PAO. The FAA has limited oversight of PAO, though such operations must continue to comply with the regulations applicable to all aircraft operating in the NAS. The government entity conducting the PAO is responsible for oversight of the operation, including aircraft airworthiness and any operational requirements imposed by the government entity. The government agency contracting for the service assumes the responsibility for oversight of a PAO.</p>
Participant H	<p>Current military flight training is not FAA certified. The military provides the pilot certifications of military aircraft. Commercial AAR companies training requirements would require an acceptance adoption by AAR companies of current MDS specific training and currency requirements.</p>
Participant I	<p>Currently, there is no way for civilian pilots to meet any qualification requirements to perform military aerial refueling for the USAF. When engaged in aerial refueling through the use of a boom, the two aircraft conjoined together by a boom are considered to be a single flying object in the sky. Because the configuration includes a military aircraft (the receiver aircraft) the entire conjoined flying object is considered to be a military aircraft. FAA air traffic controllers relinquish control when aircraft are joined by a boom for aerial refueling. The pilot of the tanker assumes air traffic control responsibility for the conjoined aerial configuration. The pilot of the tanker also assumes military command over the aircrew in the receiver as well as the tanker. The tanker pilot becomes the military</p>

	<p>commander of the receiver because the boom operator (not the pilot of the receiver aircraft) has control over the boom connection to the receiver. There is no commercial type certification for the conjoined military flying object. There is no commercial equivalent for the skill sets required to operate a tanker with a military receiver attached to the boom. There is no commercial source of training or credentialing for tanker pilots to serve as military aircraft commander during aerial refueling of military aircraft. There is no legal authority for contractor pilots employed in their civilian status to become commanders of a military aircraft and crew. The NAVAIR contract relies on the use of military pilots (i.e., Guard and Reserve pilots or pilots recently separated from the military). Because hose and drogue refueling operations are physically different than boom operations, it is unclear as to whether the Navy encounters the same issues with military command and air traffic control as the USAF encounters in USAF boom refueling flight operations. Instead, for hose and drogue operations, the pilot of the receiver aircraft is responsible for connecting the receiver snorkel to the basket dangling at the end of the hose. Simply put, commercial AAR companies cannot meet any requirements for initial or continual training qualifications for AAR crew, especially boom operators, who are qualified and current to refuel USAF military receiver aircraft. Commercial AAR fleet operators cannot obtain or maintain initial certifications for military aircraft operations, especially boom operators, booms and related avionic equipment necessary for the use of midline booms to refuel USAF military receiver aircraft. There are no commercial sources for certified, qualified boom operators who have skills and current capabilities to refuel USAF military receiver aircraft. The NAVAIR contract relies on the use of military aircrew, military training and military certifications. Commercial AAR owners of aircraft outfitted with commercial equipment required by the FAA would follow the same rules the FAA applies to all civilian-owned aircraft. Additionally, under Defense airworthiness regulations, all contractor aircraft must also undergo an engineering review for airworthiness approval by a military airworthiness authority and obtain a military flight release. They would also need review to determine the civilian equipment required by the FAA is compatible with military receiver aircraft.</p>
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There were several common themes that emerged from participant responses to RQ3: (1) training requirements to ensure the commercial refueling companies properly operate and maintain their aircraft during the contract period of performance need to be determined and enforced by the U.S. government; (2) obsolescence will remain a concern

regarding the ability of commercial AAR contractors to maintain the airworthiness of their refueling fleet; and (3) regarding airworthiness, commercial AAR operations would be required to follow the same rules and procedures that the FAA applies to all civilian-owned aircraft.

**Research Participant Responses - Research Question 4 (RQ4)**

The fourth research question sought to determine how commercial refueling companies will properly obtain approval for receiving and operating boom-equipped aircraft purchased from partner nations. Interview questions IQ7 - U.S. government agencies, military branches of service, and the private sector; and IQ7 – commercial AAR companies served to answer RQ4 and the research participants’ responses are presented in Table 6.

Table 6  
*Research Participant Responses to RQ4*

Research Participant	Research Participant Response
Participant A	Developing their training programs referencing military requirements and use of former and military reserve aircrew.
Participant B	The military would need to certify.
Participant C	There is no formalized, agreed-upon, and approved process yet. Just as any other contracted support service, it should be based upon an agreed upon set of applicable training and currency requirements that the commercial boom operator must meet.
Participant D	Same as USAF through compliance with Aerial Refueling Certification Agency (ARCA). ARCA is the organization, manned by aerial refueling subject matter experts within Air Force Life Cycle Management Center, Technical Engineering Services (AFLCMC/EZFA), tasked with executing technical aerial refueling certification/clearance activities for USAF air systems.
Participant E	We are only providing support for their operations, and training for maintenance and systems knowledge/proficiency, primarily of the avionics components. I cannot speak to how the operating company will obtain boom approval.
Participant F	No response.
Participant G	No response.

Participant H	No response.
Participant I	<p>Obtaining military approval of an aircraft has to be distinguished from approval of the people who will perform the aerial operation of a boom. With regard to the aircraft, the FAA has not process for certification or approval of civil aircraft to perform aerial refueling of USAF military receiver aircraft. Based on Department of Defense policy, USAF regulations prohibit all contractor aircraft operations (of any type, not just boom operations) until the contractor aircraft has been certified for airworthiness by the USAF airworthiness authority. Airworthiness approval depends on engineering, testing and safety reviews. These reviews require expenditure of USAF internal resources as well as contractor resources for which the USAF will have to compensate the contractor. Separately, the contractor's aircraft would also have to go through a different set of engineering and safety reviews with each type of USAF military receiver aircraft to determine if they are compatible in terms of form, fit and function. For example, some tankers cannot refuel the B-52 bomber because the metals in the tip of the boom and the metals in the skin of the bomber can create an electric arc or spark when they touch. It is unsafe when a spark occurs in the presence of fuel and oxygen. As another example, the pressure at which fuel is pumped by some tankers is too high to enable refueling of some USAF fighter jets. Not all tankers can be assumed compatible with all USAF receivers. Additionally, there is no civilian aviation status in which an aircraft can perform aerial refueling operations with a boom. Within the United States domestic/national airspace, an aircraft would have to be eligible and qualify for designation by Government officials to operate as a Public Aircraft. Currently, there is no USAF process for granting Public Aircraft status for aerial refueling of USAF receivers. Further, Public Aircraft status does not apply outside of the national airspace. As soon as the aircraft departs the national airspace, it loses its Public Aircraft status and becomes a Civil Aircraft. Turning to approval of personnel to operate a boom, there is no civilian source of civilian employees who can perform aerial refueling of USAF military aircraft. The only source is from USAF, Air Force Reserve and Air National Guard personnel who are currently certified by the military. There is no process to obtain approval or certification for civilians to perform boom operations for USAF receiver aircraft.</p>

The one common theme that emerged from participant responses to RQ4 was that the U.S. government (including the military) would have to create and implement training and certification requirements for all commercial refueling companies desiring to purchase and operate boom-equipped refueling aircraft.

## CHAPTER V

### CONCLUSIONS

The purpose of this research was to explore commercial AAR and determine if it should be considered as part of the National Defense Strategy. The findings of the study will assist in determining if commercial AAR should be researched further, implemented, or ceased for all agencies and military branches of service.

#### **Conclusions Based on Research Question 1 (RQ1)**

The first research question (RQ1) stated, “In 2021, there are 400+ U.S. military tankers in service. With this many U.S. taxpayer-funded military tankers currently in service, why is the USN already utilizing commercial AAR services, and the USAF is seriously considering it?” Based on the responses to answer RQ1, many of the research participants agreed that commercial air-to-air refueling is needed to meet the increasing demand of training and non-combat operations.

Regarding General David Goldfein’s, “Air Force We Need,” plan, it defines what the USAF should include to meet the requirements of the National Defense Strategy. The plan calls for a total of 386 operational squadrons, including 40 refueling squadrons. Because the usual refueling squadron includes 12 aircraft, that equates to 480 tankers. In comparison, the USAF specified in October 2019 they have 26 refueling squadrons consisting of 453 tankers (394 KC-135s and 59 KC-10s) (Everstine, 2020). This suggests

the USAF has only 65% of refueling squadrons and only 85% of required tankers to meet the requirements of the National Defense Strategy.

Due to this lack of tankers, it is presumed the USAF cannot support the USN's training and non-combat operations, which is why the USN has been utilizing commercial AAR services for the past several years. If the USAF only has 65% of the squadrons it needs, and only 85% of required air tankers, the impending retirements of the KC-135 and KC-10s could possibly jeopardize the USAF's efforts to support its own USAF missions; not to include other U.S. branches of services that may require the USAF's refueling support. Theoretically, this is why the USAF issued a sources sought for a bridge tankers to support the retirements of the KC-135 and KC-10 (Air Force Life Cycle Management Center, 2021). However, the USAF has stated they will not be able to declare full operational capability of the KC-46 until 2023 because the KC-46s are required to be equipped with a technologically advanced remote vision system that provides visual imagery to boom operators during a refueling (Insinna, 2021).

### **Conclusions Based on Research Question 2 (RQ2)**

The second research question (RQ2) asked, "Regarding refueling collisions, damage to the aircraft, or other mishaps during AAR missions, will the commercial refueling companies be responsible for all collateral damage to U.S. military aircraft and aircrews?" Based on the responses to RQ2, many of the research participants believed who is responsible for all collateral damage to U.S. military tankers and aircrews it is dependent on the outcome of an accident investigation to determine who is at fault and how liability is defined, legally, in the contract.

The contract will need to clearly identify liability for not only the U.S. military tankers and aircrews, but also damage and injury to private citizens affected by the results of a crash. For example, in May 2021, a pilot flying a Dassault Mirage F1 fighter jet died in a crash outside the southern perimeter of Nellis Air Force Base in Nevada. The company confirmed the pilot's death and stated that the pilot was the only person on board the aircraft (Cohen, 2021). The pilot was a contractor and the aircraft was owned and operated by Draken US, a Florida-based company that provides adversary air support for USAF pilots. Because this was a U.S. government contract involving non-military personnel, the language of the contract regarding liability must be clear and concise.

### **Conclusions Based on Research Question 3 (RQ3)**

The third research question (RQ3) asked, "How will the U.S. government ensure the commercial refueling companies properly operate and maintain their aircraft during the contract period of performance?" Based on the responses to answer RQ3, regarding obsolescence issues (IQ2 – commercial AAR companies), many research participants agreed an alignment with manufacturers and consistently upgrading obsolescence parts are crucial procedures regarding successful sustainment of aircraft used in refueling operations.

Additional research participants' responses suggested that the commercial AAR companies could consider additive manufacturing, as well as re-engineering parts to tackle DMSMS issues. The U.S. government can also include DMSMS identification from the commercial AAR contractor within the contract to ensure the commercial AAR contractor can sustain the aircraft throughout the course of the contract. Because the commercial AAR contractor is providing a service using their own aircraft, the USG may



believe it is the responsibility of the commercial AAR company to manage their own obsolescence without the USG's involvement, more like a performance-based contract. However, if the USG requests the DMSMS information, they can possibly help provide solutions, which becomes mutually beneficial to both entities, assuring the refueling aircraft maintains airworthy, thus supporting a successful AAR mission.

Based on the responses to answer RQ3, regarding the obtainment of technical data to operate aircraft (IQ3 – commercial AAR companies), the research participants emphasized how important it is to utilize technical data, especially OEM data, to ensure successful AAR operations using contracted aircraft. In addition, purchasing the necessary technical data at the same time the aircraft is purchased will alleviate additional costs; and ensuring that the technical data continues to be updated will achieve higher reliability results and overall safety of the aircraft and the crew.

In addition to addressing obsolescence and technical data to sustain the aircraft long-term, the requirements to operate the aircraft are just important. Based on the responses to answer RQ3, regarding Federal Aviation Administration commercial aircraft pilot qualifications (IQ4), many of the research participants noted that the FAA, currently, cannot certify commercial AAR pilots for refueling activities. The FAA will have to adopt new certifications for AAR and their aircrew and these new certifications will likely be very expensive for both the FAA and the commercial AAR company. Otherwise, the USG will have to address alternatives to certify the pilots during the initial phase-in of a new commercial AAR contract. Ultimately, the commercial AAR company will need to compare costs between obtaining FAA certifications for AAR and being able

to use FAA insurance versus utilizing the branch of service's airworthiness processes and paying for private insurance to cover their aircraft for AAR operations.

Based on the responses to answer RQ3, regarding training requirements for aircrew (IQ5), many of the research participants stated that the commercial AAR companies should be required to follow the same training requirements required for military aircrew. For current boom tankers, which only consist of active duty military personnel, a comprehensive training plan authored by the military must be successfully completed by all aircrews.

Based on the responses to RQ3, regarding AAR certifications for military operations (IQ6), many of the research participants agreed the JAPCC and Aerial Refueling Certification Agency (ARCA) are key stakeholders regarding the certification of aircraft for AAR activities. As stated earlier by the researcher, the USAF and the USN have their own airworthiness office. These two airworthiness offices will be a critical procedural step for the commercial AAR companies who are needing airworthiness certification to satisfy contractual agreements with each of these branches of military service.

Based on responses to RQ3, regarding how commercial AAR companies will meet FAA requirements (IQ8), many of the research participants agreed the commercial AAR companies should be required to meet all FAA requirements (ADS-B, Mode 5, Technical Data, etc.) if they enter a contractual agreement with the U.S. military. Furthermore, these commercial AAR companies should be required to stay current with FAA mandates and requirements; including maintaining Air Refueling Airworthiness Certification for all of their refueling aircraft.

Last, based on responses to RQ3, regarding sustainment of an aging fleet (IQ1 – commercial AAR companies), many of the research participants believe maximizing commercial processes and utilizing subject matter experts’ (SME) knowledge of a legacy fleet are key to long-term sustainment of aging aircraft.

#### **Conclusions Based on Research Question 4 (RQ4)**

The last research question (RQ4) stated, “How will the commercial refueling companies properly obtain approval for receiving and operating boom-equipped aircraft purchased from partner nations?” Based on the responses to RQ4, regarding obtaining boom approval (IQ7), the researcher believes the research participants understood this question to be more related to approval of personnel to operate a boom, instead of obtaining approval to get the boom as part of the aircraft purchase. Therefore, regarding authorization for commercial AAR personnel to operate a boom, many of the research participants agreed that the commercial AAR companies would have to conform to rules of compliance with the branch of military service that approved the contract. However, according to Research Participant I, there is no current process to obtain approval or certification for civilians to perform boom operations for USAF receiver aircraft. Furthermore, according to Research Participant I, only USAF, Air Force Reserve and Air National Guard personnel currently certified by the military can perform boom operations.

#### **Conclusions**

This research study sought to understand the perceptions of SMEs as it relates to AAR, and for the researcher to gain a better understanding of commercial AAR to support each military branch of service. There is a concern for the USAF to provide

refueling to the needs of the warfighter. “In the FY21 defense authorization bill, Congress prohibited the Air Force from retiring any of the 398 KC-135 until after FY23. Instead, lawmakers stipulated that the service could retire 30 KC-10s during that time period, beginning in FY21” (Insinna, 2021). According to the United States Department of Defense Fiscal Year 2022 Budget Request, to maintain a competitive edge in Rapid Global Mobility for the future fight, the USAF must continue investment in the KC-46, which requires divesting older aircraft as KC-46s are delivered to the Air Force.

The retirement of older refueling aircraft allows the USAF to transition critical manpower from KC-10s and KC-135s to the KC-46 (Office of the Undersecretary of Defense Comptroller/Chief Financial Officer, 2021). Within this same report, includes a FY22 table that illustrates the divestment of 18 KC-135s and 14 KC-10s (Office of the Undersecretary of Defense Comptroller/Chief Financial Officer, 2021). In a release by the U.S. Department of Defense on May 28, 2021, it lists the divestments of older and less-capable platforms and programs that no longer meet mission and/or security needs. These divestments include the USAF KC-135 and KC-10 refueling aircraft (U.S. Department of Defense, 2021).

Because of the scheduled perpetual retirement of these aircraft over the course of the next 10 years, along with the operational concerns and issues regarding the full integration of the KC-46 into military AAR operations, this could possibly create a significant gap for AAR support across the branches of military services. The findings from this study indicated a need for commercial AAR to support training and non-combat operations only when military tankers are not readily available; allowing the USAF and

USN to support the combat-related missions. Therefore, the NDS should consider commercial AAR as an option only when there are no military refueling capabilities.

Contracted air services has been used by the U.S. military for decades, but allowing commercial AAR companies to purchase militarized tankers, whether it is from the USAF or PNs has risks for the contractor(s). Long-term sustainment of the KC-135 and KC-10 will be the most challenging for commercial AAR companies purchasing these types of aircraft. In a GAO report from November 2020, the GAO examined a multitude of aircraft, including tankers, and found that the KC-10 had only met its mission goal in three of nine FYs, from 2011 to 2019; and the KC-135 only met its mission goal three of nine FYs as well (U.S. Government Accountability Office, 2020). In addition, based on FY18 data, it cost \$10.65 million for total operations and support per aircraft and \$4.61 million in maintenance costs per KC-135 aircraft (U.S. Government Accountability Office, 2020). In fiscal year 2018, maintenance was the largest driver for costs regarding operations and sustainment, primarily due to the aging of the aircraft (U.S. Government Accountability Office, 2020). Some of the main maintenance challenges of the KC-135 included obsolescence and corrosion (U.S. Government Accountability Office, 2020). Similar to the KC-135, based on FY18 data, it costs \$16.81 million for total operations and support per aircraft and \$6.99 million in maintenance costs per KC-10 aircraft (U.S. Government Accountability Office, 2020). In fiscal year 2018, maintenance costs per KC-10 aircraft accounted for almost 42% of the total operations and sustainment costs (U.S. Government Accountability Office, 2020). Likewise, the KC-10 is also plagued with obsolescence issues (U.S. Government Accountability Office, 2020).

Because of the internal USG inter-organizational relationships, the USAF can work more efficiently towards managing obsolescence issues for the 398 KC-135s on a larger scale; but for the commercial AAR companies, it is unknown how or where they will be able to obtain this same type of support to sustain the KC-135 even when purchasing aircraft on a much smaller scale. Creating relationships with OEMs and parts suppliers, before the purchase of the aircraft, along with authoring a robust obsolescence plan before purchasing the KC-135 or KC-10, may be a viable option for successful long-term aircraft sustainment for these commercial AAR companies; however the initial costs of standing up sustainment for a KC-135 or KC-10 will be extremely high.

Other considerations, like airworthiness and aircrew training of commercial AAR companies are also a concern because, even though these companies can utilize the USN's airworthiness authority, it will be costly to certify an aircraft and each receiver aircraft for the KC-135. If the USAF does utilize commercial refueling, they will have to determine how or if they will be the ones to certify these aircraft. In addition, these AAR companies will need to ensure they have sufficiently trained employees who can fly tanker aircraft and perform all refueling operations as per military requirements.

Last, technical data will be equally important for sustaining the KC-135 and KC-10; therefore, the commercial AAR companies will need to make arrangements with the aircraft OEM to obtain and/or update the technical data to attain higher reliability results and overall safety of their tanker aircraft and the aircrew.

### **Recommendations**

Based on the findings and conclusions of this research study the following recommendations have been formulated:

- 1) In chapter II, the researcher stated Contracted Air Services for AAR were originally directed by the Department of Defense in 2001 to meet the USN's peacetime training requirements. In 2001, Operation Enduring Freedom began; and in 2003, Operation Iraqi Freedom began (Veterans Administration, 2015). In addition, 2001 was the year of the 9/11 attack, prompting a surge in military operations. Today, the military is responding to an ever-changing global environment. Therefore, on an annual basis, the USN should re-evaluate the need for commercial AAR to determine if they have enough organic capabilities to meet their peacetime training requirements through their own refueling fleet or through the USAF. A joint study between the USN, USAF, and USTRANSCOM will help each military service branch better understand each of their mission requirements and identify gaps in AAR support.
- 2) With the USAF issuing a sources sought for a new tanker to supplement the KC-46, the USAF should consider writing the request for proposal (RFP) to encourage competition, which includes waiving the Buy American Act to find the best value contract for the USG. According to the GAO (1978), the provisions of the Buy American Act can be waived if the head of the procuring agency determines the act to be inconsistent with the public interest or the cost of acquiring the domestic product is unreasonable. Airbus could be a strong competitor, Given its Multi-Role Tanker Transport (MRTT), perhaps Airbus could effectively meet the operational capabilities for many of its first time customers, especially since the KC-46 (\$240,000,000 per aircraft) has continually been plagued with design deficiencies for a decade; delaying full-operational

capability until 2023-2024 at the earliest (Everstine, 2021). This additional tanker support could minimize or eliminate the need for commercial AAR.

- 3) In June 2021, the USN successfully conducted its first AAR refueling using probe-and-drogue mission between a FA-18 Super Hornet and a Boeing MQ-25 Stingray, an unmanned aerial refueling drone (Eckstein, 2021). Though the MQ-25 drone delivers less fuel (15,000 pounds) to designate aircraft than conventional tankers, it has successfully demonstrated that it can fulfill its refueling mission as required by the USN. The USN intends to integrate the MQ-25 and expects to achieve operational capability by 2024. With unmanned aerial refueling assets like the MQ-25, the USN should do an intensive needs-based analysis to determine if the USN can utilize the MQ-25 in lieu of commercial AAR capabilities in the future.
- 4) Sustaining tankers like the KC-10 or KC-135 will continue to be difficult for commercial AAR companies purchasing them. This difficulty is primarily due to obsolescence issues, as well as obtaining and maintaining technical data. Furthermore, since the KC-135 is repaired organically, the USAF utilizes an organic supply chain for KC-135 parts. For obtaining parts alone, the USAF will always have priority to purchase parts; thereby, the commercial AAR companies will have less priority or possibly no ability to access KC-135 parts (Department of Defense, 2005). If the USAF pursues commercial AAR, it is recommended that the USAF ensure its contractual agreements with the commercial AAR companies are performance-based with incentives and penalties or disincentives for missed refueling sorties.



## **Further Research**

In June 2021, the USAF approved a plan to develop a business case analysis (BCA) for commercial AAR. According to the Air Mobility Command, the BCA would take between 12 and 18 months to complete (Albon, 2021). Regarding the analysis, it is important that the USAF thoroughly research: (1) sustainment challenges for aging aircraft to include ability to repair and obtain parts, (2) potential gaps in military AAR, and (3) the overall benefits of providing commercial AAR to the USAF.

The second recommendation for further research is the responsibility of the Designated Airworthiness Representative when commercial AAR companies purchase military AAR aircraft. These AAR companies are required to provide applicable and current technical data to operate and sustain the aircraft. The DAR must have the necessary professional experience or knowledge in these types of aircraft to determine airworthiness when non-military contractors purchase the aircraft. The research study would need to focus on additional training requirements and an in-depth review of a DAR and commercial AAR company's relationship to eliminate the possibility of collusion.

Last, the third recommendation for further research is for the U.S. government to reexamine their process for demilitarized aircraft and third part transfers before selling U.S. militarized equipment and aircraft to countries and before countries hand over their aircraft to other countries or commercial AAR companies. On August 16, 2021, the Taliban took over Afghanistan's airfield in Kandahar. Thereafter, they took over the Mazar-i-Sharif airport. Numerous pictures and videos were taken of Taliban members standing next to military aircraft and equipment the U.S. government provided to the Afghanistan military during the past 20 years. The U.S. government has not publicly

confirmed how many military aircraft the Taliban seized, but “the Afghan Air Force operated a total of 211 aircraft, with about 167 planes and helicopters available for use as of June 30, 2021” (Insinna, 2021, para. 4). Now, the U.S. government is at risk of Russia, Iran, or China potentially purchasing U.S. aircraft from the Taliban to reverse engineer the aircraft to utilize technological findings for their own military benefit. From the perspective of selling to a commercial company, the Royal Australian Air Force (RAAF) sold 46 F/A-18 Hornets to a commercial company to be used as contractor adversary air support (Rogoway, 2020, para. 1). The aircraft is equipped with the AN/APG-73 radar which is used for air-to-air and air-to surface missions and is operationally used by the USN, USMC, and country partners (Raytheon, n.d., para. 4). Did these aircraft go through the demilitarization process to remove cryptologic capabilities? Does the USG do its due diligence in ensuring that a commercial company can or should obtain unique military systems like they do for country partners? When country partners want a certain capability, they go through an extensive process which is laid out in the SAMM Chapter III, for release of certain information and technology transfer through a pre-LOR Assessment Request (PAR), involves International Traffic in Arms Regulations (ITAR), export licenses, customs clearances, and can include items on the U.S. Munitions List (USML) (SAMM, 2012). Is the USG following this same or a similar process when a commercial company purchases military unique weapon systems?

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## APPENDICES

APPENDIX A  
Cover Letter

## Commercial Air-to-Air Refueling



The intent of this study is to examine if commercial refueling is a benefit to the military; whether its services are used for training exercises, testing aircraft, real-world operations, or other requirements from both the military and private sector entities. The participants for this research study will consist of approximately 25 USG and contractor organizations, men and women aged 18 years and older, who are considered stakeholders as it relates to air-to-air refueling.

The researcher, *Ms. Katie Ward, Oklahoma State University Doctoral candidate*, strongly believes the information obtained in this research initiative can be a springboard to facilitate discussion and offer a way for the nation's collegiate aviation community to proceed proactively in addressing emerging areas of concern.

Your participation in this research study is **strictly voluntary**. Your response to each survey question will remain confidential and will be used solely for statistical analysis. It will be understood by the researchers if you complete this survey and submit your responses back to the researchers, you have agreed and given your consent to participate in this study.

The researcher of this research study personally *thank you* for your feedback and support of this research. The final research report will be presented at a professional aviation or educational conference and published in a peer-reviewed aviation or educational journal.

If you have questions regarding this study, please contact Ms. Katie Ward at [katie.r.ward@okstate.edu](mailto:katie.r.ward@okstate.edu) or Dr. Timm Bliss, Aviation Professor, Oklahoma State University at [timmm.bliss@okstate.edu](mailto:timmm.bliss@okstate.edu).

APPENDIX B  
Research Instrument – Commercial Air-to-Air Refueling – Government Agencies,  
Military Branches of Service, or Private Sector

# **Commercial Air-to-Air Refueling - Government Agencies, Military Branches of Service, or Private Sector**

Please provide all requested information. Your responses will be kept confidential.

## **I. Demographics**

1. What is your age?

- |                                |                                |                                      |
|--------------------------------|--------------------------------|--------------------------------------|
| <input type="checkbox"/> 18-24 | <input type="checkbox"/> 25-34 | <input type="checkbox"/> 35-44       |
| <input type="checkbox"/> 45-54 | <input type="checkbox"/> 55-64 | <input type="checkbox"/> 65 or older |

2. What is the highest degree or level of school you have completed?

- |   |   |
|---|---|
| <input type="checkbox"/> High School Diploma or GED     | <input type="checkbox"/> Bachelor's Degree                |
| <input type="checkbox"/> Some College Credit, No Degree | <input type="checkbox"/> Master's Degree                  |
| <input type="checkbox"/> Associate Degree               | <input type="checkbox"/> Doctorate or Professional Degree |

## **II. Questions**

**IQ1:** What is your current fleet size, future fleet size, and/or mission requirements related to commercial air-to-air refueling?

**IQ2:** What is the purpose for utilizing commercial refueling companies in lieu of military tankers?

**IQ3:** What are your thoughts on U.S taxpayers paying for commercial refueling when there are military utilized for refueling purposes?

**IQ4:** Federal Aviation Administration (FAA) commercial aircraft pilot qualifications require specific flight hours, flight training (emergency recovery), and type model certification. How will commercial AAR aircraft pilots meet these FAA regulatory requirements for pilot certification and type model certification on a military aircraft that was previous excluded from these FAA requirements?

**IQ5:** Military aircrew positions have regulations and training doctrine for successfully attaining and maintaining a qualified status. How will commercial AAR companies meet similar continual training requirements?

**IQ6:** How will the commercial AAR fleet maintain AAR certifications required for military aircraft operations?

**IQ7:** What is the process for obtaining boom operation approval for the commercial AAR companies?

**IQ8:** How will commercial AAR companies meet FAA requirements (e.g. ADS-B, Mode 5, etc.)?

**IQ9:** What is your ten-year plan for AAR services, whether it is military or commercial AAR?

**IQ10:** Who is liable for mishaps or crashes that may occur while a contractor performs AAR services?

### **III. Personal Comments**

Please indicate any additional comments you may have regarding commercial air-to-air refueling.



APPENDIX C  
Research Instrument – Commercial Air-to-Air Refueling – Commercial AAR Companies

# Commercial Air-to-Air Refueling – Commercial AAR

## Companies

Please provide all requested information. Your responses will be kept confidential.

### Demographics

1. What is your age?

- |                                |                                |                                      |
|--------------------------------|--------------------------------|--------------------------------------|
| <input type="checkbox"/> 18-24 | <input type="checkbox"/> 25-34 | <input type="checkbox"/> 35-44       |
| <input type="checkbox"/> 45-54 | <input type="checkbox"/> 55-64 | <input type="checkbox"/> 65 or older |

2. What is the highest degree or level of school you have completed?

- |   |   |
|---|---|
| <input type="checkbox"/> High School Diploma or GED     | <input type="checkbox"/> Bachelor's Degree                |
| <input type="checkbox"/> Some College Credit, No Degree | <input type="checkbox"/> Master's Degree                  |
| <input type="checkbox"/> Associate Degree               | <input type="checkbox"/> Doctorate or Professional Degree |

### II. Questions

**IQ1:** What is your process to sustain an aging fleet to support your AAR customers (maintenance, repair, overhaul, etc.)?

**IQ2:** Specifically, what are you doing to address obtaining parts and obsolescence issues, known as Diminishing Manufacturers Sources Material Shortages (DMSMS)?

**IQ3:** How do you obtain the necessary technical data (e.g. technical orders/maintenance manuals, flight manuals) in order to operate your fleet?

**IQ4:** Federal Aviation Administration (FAA) commercial aircraft pilot qualifications require a specific number flight hours, flight training (emergency recovery), and type model certification. How will your civilian AAR aircraft pilots meet these FAA regulatory requirements for pilot certification and type model certification on a military aircraft that was previous excluded from these FAA requirements?

- IQ5:** Military aircrew positions have regulations and training doctrine for successfully attaining and maintaining a qualified status. How will your aircrews meet similar continual training requirements?
- IQ6:** How will your fleet maintain AAR certifications for operating with military aircraft?
- IQ7:** What has been your process for obtaining boom operation approval?
- IQ8:** Does your aircraft currently meet FAA requirements (e.g. ADS-B, Mode 5, etc.) and if not, what are your plans for meeting them while maintaining the aircrafts' Air Refueling Airworthiness Certification?
- IQ9:** As the commercial AAR contractor, who is liable for mishaps or crashes that may occur while performing AAR services?
- IQ10:** Why do you think the government uses commercial AAR in lieu of military tankers?
- IQ11:** Where is your aircraft operations?

**III. Personal Comments**

Please indicate any additional comments you may have regarding commercial air-to-air refueling.

APPENDIX D  
Consent Letter

**OKLAHOMA STATE UNIVERSITY  
COLLEGE OF EDUCATION, HEALTH, AND AVIATION  
PARTICIPANT INFORMATION AND CONSENT FORM**

**Title:** Commercial Air-to-Air Refueling

**Investigator:** Ms. Katie R. Ward

**Purpose:** The intent of this study is to examine if commercial refueling is a benefit to the National Defense Strategy (NDS); whether its services are used for training exercises, testing aircraft, real-world operations, or other requirements from both the military and private sector entities.

**What to Expect:** This research study is administered online via Qualtrics. Participation in this research will involve completion of a questionnaire. The questionnaire has three sections, the first section is demographic information. The second section has questions regarding mission requirements, commercial air-to-air refueling, requirements to perform air-to-air refueling, and more. The last section asks for any personal comments. You will be expected to complete the questionnaire once. It should take you approximately 15-30 minutes to complete, depending on your responses.

**Risks:** There are no risks associated with this project which are expected to be greater than those ordinarily encountered in daily life.

**Benefits:** There are no direct benefits to you. However, you may gain an appreciation and understanding of how this research is conducted and the outcome.

**Your Rights and Confidentiality:** Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time. The records of this study will be kept private. Any written results will discuss group findings and will not include information that will identify you or your organization. Research records will be stored on a password protected computer in a locked office and only researchers and individuals responsible for research oversight will have access to the records. Data will be destroyed within two years after the completion of this research study.

**Contacts:** Should you desire to discuss your participation in the study and/or request information about the results of the study: please contact Ms. Katie Ward at [katie.r.ward@okstate.edu](mailto:katie.r.ward@okstate.edu) or Dr. Timm Bliss, Aviation Professor, Oklahoma State University at [tim.b Bliss@okstate.edu](mailto:tim.b Bliss@okstate.edu). If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or [irb@okstate.edu](mailto:irb@okstate.edu)

**If you choose to participate:** Please, click NEXT if you choose to participate. By clicking NEXT, you are indicating that you freely and voluntarily and agree to participate in this study and you also acknowledge that you are at least 18 years of age. It is

recommended that you print a copy of this consent page for your records before you begin the study by clicking below.

APPENDIX E  
IRB Approval



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**From:** IRB Office <[irb@okstate.edu](mailto:irb@okstate.edu)>  
**Sent:** Thursday, March 18, 2021 2:37:05 PM  
**To:** Bliss, Timm <[tim.bliss@okstate.edu](mailto:tim.bliss@okstate.edu)>; Ward, Katie <[katie.r.ward@okstate.edu](mailto:katie.r.ward@okstate.edu)>; Ward, Katie <[katie.r.ward@okstate.edu](mailto:katie.r.ward@okstate.edu)>  
**Subject:** Approval of Exempt IRB Application IRB-21-136

Dear Katie Ward,

The Oklahoma State University Institutional Review Board (IRB) has approved the following application:

Application Number: IRB-21-136  
PI: Katie Ward  
Title: Examination of Commercial Aerial Refueling and Consideration as Part of the National Defense Strategy  
Review Level: Exempt

You will find a copy of your Approval Letter in IRBManager. Click [IRB - Initial Submission](#) to go directly to the event page. Please click attachments in the upper left of the screen. The approval letter is under "Generated Docs." Stamped recruitment and consent documents can also be found in this location under "Attachments". Only the approved versions of these documents may be used during the conduct of your research.

As Principal Investigator, it is your responsibility to do the following:

- Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted for IRB approval before implementation.
- Submit a request for continuation if the study extends beyond the approval period.
- Report any adverse events to the IRB Chair within 5 days. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
- Notify the IRB office when your research project is complete by submitting a closure form via IRBManager.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB office at 405-744-3377 or [irb@okstate.edu](mailto:irb@okstate.edu).

Best of luck with your research,

Sincerely,

Dawnett Watkins, CIP

---

Oklahoma State University  
Institutional Review Board  
Office of University Research Compliance  
223 Scott Hall, Stillwater, OK 74078  
Website: <https://irb.okstate.edu/>  
Ph: 405-744-3377 | Fax: 405-744-4335 | [irb@okstate.edu](mailto:irb@okstate.edu)

VITA

Katie Renee Ward

Candidate for the Degree of

Doctor of Education

Dissertation: EXAMINATION OF COMMERCIAL AERIAL REFUELING AS PART  
OF THE NATIONAL DEFENSE STRATEGY

Major Field: Applied Educational Studies

Biographical:

Education:

Completed the requirements for the Doctor of Education in Applied Educational Studies at Oklahoma State University, Stillwater, Oklahoma in December, 2021.

Completed the requirements for the Master of Science in Military Operational Art and Science at Air University, Maxwell Air Force Base, Alabama in 2013.

Completed the requirements for the Master of Arts in Procurement and Acquisitions Management at Webster University, St. Louis, Missouri in 2009.

Completed the requirements for the Bachelor of Arts in Administrative Leadership at University of Oklahoma, Norman, Oklahoma in 2006.

Experience:

Acquisition Logistician - Single Channel Anti-Jam Man-portable Terminal, Secure Mobile Anti-Jam Reliable Tactical Terminal, Extremely High Frequency Antenna Support Shelter, Advanced Extremely High Frequency, T-1A, C-12, F117 Engine, Manpower and Personnel, C/KC-135, Department of the Air Force, 2006 to Present.

Professional Memberships:

The International Society of Logistics