6 PAGER PROPOSAL:
USAF AIR REFUELING OPERATIONS

PROJECT FLASHPOINT
APRIL 2023

1. PROJECT BACKGROUND AND DESCRIPTION

This document provides a high-level overview of Team Flashpoint's Chief of Staff Innovation Leadership Seminar (CHILS) sponsored project, the current state of Air Refueling (AR) operations in the United States Air Force (USAF) and outline the team's focus for the remainder of 2023. Our objective is to analyze key elements of aerial refueling command and control (C2), identify issues and risks, develop innovative solutions to address them, lay out an experimentation plan to assess the effectiveness of the proposed solutions, and build a coalition of airmen willing to implement change.

Air refueling operations are guided by CJCS-outlined priorities. USTRANSCOM oversees the AR enterprise and extends authorities and execution to worldwide AOCs who are resourced by Air Mobility Command (AMC). Allocation of AR assets is a centralized decision-making process currently composed of nine disparate systems and siloed data landscapes. As such, the process does not allow for rapid decision making in a closed loop system across all required users at the tactical, operational, and strategic level. The narrowly scoped, single purpose systems have varying degrees of compatibility and integration with like or supporting systems (see appendix B). The USAF has successfully executed AR operations using current systems during peacetime and active conflict, despite resource and procedural inefficiencies. To address future challenges associated with Agile Combat Employment (ACE) environments, AR C2 decision making processes, and its supporting technologies must evolve to enable and deliver accelerated decision-making and operational resilience during active conflict.

Commonly referred to as tanker operations, AR consistently receives attention from senior leaders, but that attention has been narrowly focused on current and future tanker aircraft capability and capacity. Components of tanker operations that receive less attention include the ability to procure petroleum products, specifically aviation fuel, the ability to store fuel, and the ability to distribute fuel. Underpinning these components is the ability to effectively manage resources (i.e., C2). This includes prioritizing AR requests, allocating AR platforms, and assessing risk to current and future AR operations. Recent AR C2 modernization efforts focused on enhancing IT systems and have delivered only incremental improvements because the fundamental premise of AR C2, centralized decision making, has not evolved. Due to previous modernization efforts being limited in scope and unsynchronized, today's AR decision-making process is slow, hierarchical, efficiency focused on the expense of effectiveness, labor-intensive and brittle. As a result, the current AR environment cannot generate updates in a closed-loop system as speeds needed to enable tactical, operational, or strategic decision advantage. An AR C2 ecosystem predicated of centralized control implemented by disaggregated IT systems cannot evolve to deliver the decision-making capability commanders need in today's national security environment.

The Project Flashpoint envisions a capability that provides a secure, user defined, map-based, AR common operating picture. The AR Common Operating Picture (COP) will be configurable to display

short term and long-range AT schedules based on real-time tanker tracking data. This AR COP will also be updated in near-real time as conditions change. The technical implementation of the capability will be scalable and secured for use worldwide by all services, partners, and allies.

The intent for the first phase of this project is to address lower priority requests as a proof-of-concept. The objective system will augment the current capabilities of ARST and replace Facebook as an alternative method for scheduling low priority missions. The solution will interface with existing ARMS, ARST, and GDSS data to simplify the tanker allocation process from the end user perspective. Efficiencies gained will allow AMC's Aerial Refueling Liaison Office (ARLO) to oversee the program, integrate better with ARMS, and identify additional opportunities for optimization.

2. GUIDING PRINCIPLES

The following six guiding principles will inform Flashpoint activities:

1. **Decisions should be made as close to the point of impact as possible.** A byproduct of emerging warfighting concepts emphasizing scheme of maneuver and disaggregating forces, requires an element of decentralized command and control. Regardless of the operating environment, we will prioritize strategies that enable the right warfighter in the right place at the right time to make the decision.
2. **Decision speed matters.** Speed is critical in battle for decision advantage. Our team will evaluate and prioritize strategies that improve the ability of the warfighter to make decisions at operationally relevant speeds.
3. **Decision speed and information quality should not be mutually exclusive.** We do not believe the warfighter must choose between speed and quality as inherent tradeoffs within the decision-making process. Therefore, our prioritization of speed DOES NOT mean a de-emphasis on informed decision making. The information needed to make informed decisions is available, but it must be liberated. Liberating information will be a priority.
4. **Federated decision-making increases operational resiliency.** Federated decision making dynamically networks decision makers at levels required by the nature of the situation. We will prioritize the need to craft a solution that increases the resiliency and redundancy of decision making through a federated framework.
5. **Replace legacy stovepipes whenever possible.** Underpinning all of aspects of this project is the need to tear down stovepipes that are the legacy IT systems, siloed data sets, and geographically focused decision making. We will prioritize strategies that deliver capabilities that revolutionize the myriad stovepipes that define today's aerial refueling command and control enterprise.
6. **Increase resource efficiency and optimize existing processes.** An unknown amount of resource inefficiency exists in today's AR decision-making process and execution. Our solution will incorporate the guiding principle of increasing resource efficiency and process optimization relative to today's AR asset allocation processes and mission execution to maximize effectiveness.

3. GOALS

In 2023, we will pursue the following goals:

- **Identify the problem:** Analyze AR allocation authorities, policies, and associated systems to identify the root causes of AR allocation process rigidity, manually and time intensive; composed of disaggregate champions trying to solve; and not providing the war fighter decision advantage.
- **Develop, assess, and propose solutions:** Craft innovative solutions to policy, authorities, and processes.
- **Obtain a sponsor:** Garner support of senior leader(s) able to provide Team Flashpoint with access to key process stakeholders, data and software technicians, and dedicated mentorship.
- **Build a coalition for innovation:** Create opportunities for understanding our efforts and engage in collaborative sessions with stakeholders at the tactical, operational, and strategic level to establish buy-in.
- **Map Critical Path to Scale**: Detail ways and means necessary to scale solution from current focus (priority 3 & 4 missions) to encapsulating all aspects of AR C2.

4. STATE OF THE USAF AIR REFUELING

The process to allocate tankers consists of policy, request submissions, multiple IT systems, a multi-level validation processes, wing reporting of aircraft and crew availability, and the effort to match validated requests with available resources. Efforts to modernize tanker command and control processes and technology are abundant but have not been synchronized, resulting in disparate systems that do not scale vertically or horizontally or enhance decisions. See Appendix B for a description of recent modernization efforts.

Policy

USTRANSCOM validates all AR support based on Joint Chiefs of Staff (CJCS) designated priority of the receiver flight mission, in accordance with CJCSI 4120.02D. To qualify as a priority 1, 2, or 3 requirements, the AR request must be considered mission essential.

Request submission

Currently, tanker allocations involve multiple systems for gathering requests and often require multiple systems for submitting and validating a request.

Late requests, specifically priority 1 & 2 requests, create a significant, manually intensive effort to fulfill, sometimes resulting in cancellations of other requests without visibility on the effects. Duplicate requests are common in the test community because the units don't see requests submitted by other units involved in the test activity.

IT Systems

The **Air Refueling Management System** (ARMS) is the sole vehicle for receiver units and other requesting agencies to submit, modify, or cancel CJCS priority 1 and 2 (operational) AR requests. ARMS also serves as the sole vehicle for submitting, changing, or canceling all Coronet AR requests, regardless of CJCS priority.

The **Air Refueling Scheduling Tool** (ARST) is the USAF system of record for matching receiver training air refueling needs (CJCS priority 3 and 4) to tanker capacity.

Validation Process

MAJCOM validators review each support request and either approve the request or return it to the requesting unit for amendment. A MAJCOM-validated request is then reviewed by the USTRANSCOM validator and either approved, returned to the MAJCOM validator, or re-negotiated with the requesting unit. Utilizing 9 separate IT systems, USTRANSCOM validates and passes approximately 12,000 requests per year to the AOCs.

Aircraft and Crew Availability

Aircraft and crew availability are determined using the Mobility AFFORGEN model referred to as the RDAP (Readiness Driven Allocation Program).

Per RDAP, once a month wing representatives provide the 618th AOC the number of aircraft and crews that will be available for HHQ taskings via a locally generated document. The same representatives provide a daily update on aircraft and crew availability for HHQ taskings also via a locally generated document. The locally generated documents provided by the wings are the source documentation for aircraft and crew availability as determined by the RDAP and establish the foundation of the process that matches requests with available resources.

Resource Matching

Within an AOC, standard operating procedures permit one person working within “the barrel” (office within AOC that makes allocation decision) to make allocation decisions that will ultimately be reflected on a locally generated form known as “the matrix.” Allocation decisions made in the “barrel” cannot be reflected on the “matrix” without short-range planners checking tanker performance capability on stand-alone spreadsheet documents. Additionally, allocators within the “barrel” are only allowed one request to be matched with one tanker at a time. Constraints (Special Operations, quiet hours, weekend closures, etc.) must be managed manually and require extensive amounts of time on the phone between the AOC.

5. PROJECT FLASHPOINT PERSPECTIVE

Lessons Learned

The USAF AR culture is centered upon centralized decision making at the operational level. As such, both the IT systems currently fielded and those in development are in support of a culture that values centralized decision making for every scenario. Therefore, each modernization effort’s overarching goal is to further centralize data streams, limit stakeholder participation, and optimize the decision process for a select few. Although such a solution is feasible, resuscitating the same approach to solving the problem inspires little confidence the process can be evolved to meet today’s security environment.

The personal experiences of project team members, and the user stories we gathered during interviews lead us to conclude information sharing and decision making need to be proliferated across the tactical, operational, and strategic level.

Decentralizing decision making via crowdsourcing technology will address the challenges identified as it has been in use for several years, albeit inconspicuously. Although we do not have the data to support our claim, based on the amount of members utilizing open-source social media tools to crowdsource low-priority AR missions, social media-based crowdsourcing appears to be more effective than today’s process.

Impression

Research indicates the process outlined above is rigid, time consuming, inefficient, and ineffective with regards to lower priority missions. For instance, the CJCSI is written in such a way that priorities are interpreted subjectively; the process is optimized for requests submitted month(s) in advance; no mechanisms are provided to revisit requests determined to be unsupportable; and limiting allocation decision making to one person reduces analytical capacity to one person focused on a singular task. Additionally, as AOCs do not have the ability to seamlessly share information across AORs, coordination between AOCs is labor-intensive, time consuming, inefficient, and in an active ACE environment, will likely be operationally ineffective.

Applicability

A modern solution to fulfill priority 3 and 4 AR requests is needed in today's USAF. From our own experiences and interviews with AR experts, pilots have been coordinating AR support via social media for missions deemed unsupportable by for several years. This is strong indication that crowdsourcing AR requests directly between stakeholders is a more effective approach than what exists today.

Stakeholders participating in AR support crowdsourcing should be airmen at all three echelons who have assigned roles AR asset allocation. At the tactical level, airmen in the operational units who are focused on mission planning, training certification, and scheduling of AR missions whether they (squadron) be the receiver or the supplier of AR. For the operational level, airmen at the different AOCs, combatant command operations centers, and other component command organizations who have vested interest in the planning, scheduling, and execution of AR. At the strategic level, the need for senior leaders to have awareness of capability and capacity cannot be understated. Excessive time and energy are spent executing today's process to provide senior leaders opportunity to orient themselves to an environment, reducing time available to make operationally relevant decisions.

Supporting data also needs to be available at all three echelons. Data of low utility to one echelon may be critical to another. Specifically, airmen within the "crowd" must be able to view submitted AR requests, planned AR missions, AR asset availability, and planned priority one and two missions. The data must not be bound regionally or by duty status (i.e., active, guard, reserve forces). For priority one and two missions, scenarios that are not only possible, but highly probable exist where an AR asset (e.g., KC-135) executes a high priority mission but has excess capacity in terms of on-board fuel and/or transit time to home station. These scenarios must be viewable at the tactical level to allow airmen to capitalize on available underutilized capacity.

Scalability

The question must be asked whether the USAF needs to invest in a solution geared only towards priority 3 and 4 missions? Project Flashpoint believes the answer is yes. Although the proposed solution can increase the efficiency and effectiveness of scheduling low priority missions, the true power of the solution is in the ability to drastically improve the process of matching user requests with a service provider. When pilots can crowdsource their individual need for fuel, the ability to share information across commands, and match emerging requests with available assets at the speed of relevancy in a decentralized manner will become standard tools in the AR toolbox. AR consumers will have the ability to communicate a need to any AR producer, and operating under commander's intent, will be able to determine if they have the capability and capacity to assist the consumer. This approach can be scaled to support the decentralized, federated command and control concepts that are critical for the service's future operating concepts.

Finally, scheduling AR support is not the only instance in which airmen are utilizing social media to crowdsource solutions current centralized processes are not designed to support. Maintainers, logisticians, and many other career fields have been solving problems for years through crowdsourcing, but the service and its processes have not evolved.

To be clear, crowdsourcing all AR requests in every region of the world is not what Project Flashpoint is proposing. The solution proposed provides airmen at all levels the capability to solve a problem rapidly given their commander's intent when conventional processes fail.

Support to ACE

The current centralized structure of executing command and control from a theater Air Operations Center (AOC) will not scale in the contested, agile environment anticipated during conflict with a peer adversary. Any kinetic or non-kinetic attack can easily confuse or disrupt the AOC-centered approach to running an air campaign. Additionally, the Agile Combat Employment (ACE) concept further complicates an AOC's ability to command and control across disaggregated, austere forward operating locations in contested environments.

The ACE concept involves several different techniques, including pre-positioning of fuel, equipment, and supplies, using expeditionary airfields, and leveraging new technologies and communication systems to maintain situational awareness and coordinate operations. It emphasizes the need for flexibility and adaptability, with units being able to quickly shift focus or change missions based on operational requirements. The overall purpose of ACE is to enhance resilience and ability act with agility in response to threats in a dynamic environment to increase survivability and maintaining the ability to generating combat power (Air Force Doctrine 1-21, 2022).

Air Combat Command's Lead Wing concept is a key element of ACE and involves a designated group of aircraft and personnel responsible for rapidly establishing air operations in a new location. The Lead Wing is typically composed of small, highly trained teams of airmen who can deploy rapidly with minimal support to establish a temporary operating location. Once established, the Lead Wing is responsible for setting up airfield operations and supporting combat operations as needed for a limited amount of time. This allows for a rapid and flexible response to changing operational requirements, while also reducing the overall footprint and logistical burden associated with traditional air operations.

Lead Wings adhere to ACE doctrine and techniques to rapidly disperse and operate from multiple locations, often with limited infrastructure, to better support combat operations. They must also be able to execute Mission Command and rapidly generate missions during high-end combat against a peer adversary. Doing so requires enabling requirements such as airlift, base defense, communications infrastructure, munitions support, medical, and airfield operations to be organic parts of the Lead Wing. Unfortunately, Air Refueling will not be "chopped" to the Lead Wing for organic AR support, which complicates rapid mission planning and generation.

Normal timelines required to coordinate Air Refueling for a fighter movement can vary based on the size and complexity of the movement and the operational environment. At a minimum, the 618th AOC is required to identify supporting tanker units No Later Than (NLT) 10 days prior to the mission date for Coronet movement. Combatant Commanders with Operational Control (OPCON) of their own tankers may be able to provide tanker support faster than the 618th AOC in some cases, but recently we have seen that a unit of 14 F-16 Vipers moving from Korat, Thailand to Kadena Air Base, Japan were on a 6-week delay due to anker support delays (Facebook, Tanker Business Effort Marketplace, 2023).

The rapid timelines associated with ACE operations do not align with the current centralized Air Refueling scheduling processes governed by AFI 11-221. While some situations, such as training or peacetime exercises, may allow for long-term planning, units executing ACE in a contingency environment will require significantly shorter planning cycles and will require maximum visibility of their needs. Lead Wings, as an example of the Combat Air Force's ACE-capable operational Wing, need to be able to conduct Movement and Maneuver, and quickly generate missions from dispersed locations during high-end combat. The assumption with this "high-end" combat is that communications with the AOC may be broken or jammed, and this Lead Wing will likely be cut-off from HHQ and forced to use its own C2 architecture and Wing HQ for planning and direction. The Lead Wing will be required to generate its own tasking orders to subordinate elements to meet the CCDR intent, but without organic AR support attached to the Lead Wing, these operations will not succeed without tanker support in the vast distances of an Indo-Pacific fight. Therefore, Lead Wing Operations Centers (or units at the tactical level executing Mission Command) will require the visibility of available tankers, the ability to schedule tankers at the time and place of need, and the ability to operate without the strict management from HHQ or the AOC.

Overall, the above scenario illustrates why there is a need add decentralized Air Refueling asset allocation options to the existing centralized methods. While crowdsourcing may not be reliable to fill all requirements in every scenario, there exists a warfighter validated need for maximum visibility of tanker assets and the ability to manage those assets at the tactical level when priority dictates.

6. STRATEGIC PRIORITIES

In 2023 Team Flashpoint's strategic priorities are to identify the problem surrounding effective AR C2; develop, assess, and propose a solution to the problem; obtain a sponsor(s) who are willing to support, refine, and advance the team's solution; and build a coalition of airmen across the AR enterprise who support the team's initiative; and map a critical path to scale the solution.

6.1 Identify the Problem

Since Project Flashpoint inception, the problem the team is working to solve has evolved in concert with the collective knowledge of the team. As such, the team acknowledges the reality that the problem definition will continue to evolve throughout 2023. The goal is to remain mindful that as the knowledge and understanding of the team advances, so too will the problem definition.

As of this writing, the problem is defined as:

> *The current system for worldwide aerial refueling allocation is composed of disparate systems and siloed data landscapes, and the process does not allow for rapid decision making in a closed loop system across all required users at the tactical, operational, and strategic level*.

6.2 Develop, Assess, and Propose a Solution

The project team will work to develop, assess, and propose a solution to the problem statement listed above over the course of 2023. At this stage of the process, Team Flashpoint will focus on creating a solution through descriptive words outlining the characteristics and capabilities, and not narrowly define a tool or widget. As the process progresses, the team will translate the characteristics and capabilities into a more defined tool, but not at this time.

Key characteristics that define the solution space are decentralized decision making; federated C2; speed always; informed personnel at the tactical, operational, and strategic level; thrives in unanticipated or chaotic environments; prioritizes effectiveness over efficiency.

Regarding capabilities, the team is focused on a solution that combines the principles of crowdsourcing and the decision-support benefits of operations research algorithms. The solution will have the capability of accessibility to airmen at all levels, while also capable of empowering lower-echelon airmen to make allocation decisions. The early phases of solution development will exclusively focus on lower-echelon decision making (i.e. priority 3 & 4 AR missions), but all AR missions (priority 1-4) will be viewable at all levels throughout all phases of development.

6.3 Obtain a Sponsor

Aspects of the Project Flashpoint's solution runs counter to cultural norms within the AR community, specifically delegated allocation authority via crowdsourcing. While the team is confident ardent supporters of this solution are numerous, the team is assured it will encounter ample amounts of resistance or indifference from stakeholders within the AR community. Therefore in 2023 Team Flashpoint must obtain a sponsor with the ability to provide access to experts and resources, serve as an influential voice within the AR community, and guide the team through the process. Specifically, the team will ask the sponsor to assist in

1. Craft policy changes permitting airmen at the tactical level to have access to data regarding current and future priority 1 & 2 missions; policy documents include United States Transportation Command Instruction 10-25, *Air Refueling,* and AFI 11-221, *AIR REFUELING MANAGEMENT.*
2. Craft policy changes giving airmen overt permission to coordinate priority 3 & 4 missions via crowdsourcing; policy documents include United States Transportation Command Instruction 10-25, *Air Refueling,* and AFI 11-221, *AIR REFUELING MANAGEMENT*.
3. Counter the cultural norms within the AR community which places an emphasis on centralized decision making.
4. Drive data-stream integration amongst ARMS, ARST, and other AR IT systems containing relevant, but siloed data, into a minimum viable product (MVP) in support of the solution.
5. Commit funds to develop an operations research algorithm capable of recommending receive-provider matches based on current and future AR missions within the MVP.

6.4. Build a Coalition of Innovation

As a result of numerous interviews and literature reviews, Team Flashpoint is confident a considerable amount of the AR community is embracing the CSAF's call to accelerate change. The team's priority in 2023 is to harness the innovative thrust that already exists and provide it with an agreed upon vector. To accomplish this priority, the team will need to engage the different stakeholders through various means. This priority will be time consuming, slow, and at times frustrating, but Team Flashpoint sees the multiple, un-supporting vectors of innovation as putting a drag on modernization efforts. A combined effort to sync innovation in the AR community is necessary to provide effective solutions at the speed of relevancy for the entire force.

6.5 Map Critical Path to Scale

As discussed in the lessons learned section, effective AR allocation for low priority missions via crowdsourcing has been happening for years. A strategic priority for this team will be to build upon the solution developed in priority 6.2 to enable scaling vertically (priority 1&2 missions) and horizontally

(AOCs, service, allies, etc.). In 2023, the team must generate a detailed map outlining the ways in which the solution can scale to encompass the entirety of the AR decision making process.

7. APPENDIX A: Business Plan

TBD

8. APPENDIX B: Existing System Descriptions

Recent Air Refueling system modernization efforts include.

- **Air Refueling Liaison Office:** An office in the Tanker Airlift Control Center that assigns support for Priority 3 and 4 AR requests.
- **CAMPS**: A command-and-control (C2) system that enables effective planning and scheduling of airlift and tanker aircraft missions during peacetime, contingency, humanitarian, and wartime operations. Provides the status of air mobility planning and scheduling activities, from initial tasking through mission completion. The C2 system provides an integrated view of mobility requirements, resources, and commitments using network-centric data solutions and a commercial off-the-shelf graphical interface. It helps ensure the efficient allocation of aircrews and aircraft – a top priority for the AMC, which must meet increased global demands for airlift missions with less capacity and at a lower cost. As a subcontractor to DPRA, a company called Tapestry will provide software development, operations, and training as a follow-on to the CAMPS sustainment contract awarded in 2011.
- **GDSS:** Mobility Air Forces (MAF's) principal C2 system, GDSS is the execution authority for mission management, providing robust capabilities in a net-centric environment, and allowing access and information sharing across unclassified and classified domains using continuous multi-master replicated databases.
- **Jigsaw:** Developed by the Air Force's in-house software development team, Kessel Run, to handle refueling tanker planning in the Middle East and expanded to NATO in 2020. The program brings together data from current, previous, and planned tanker operations to plan the most effective missions for deployed aircraft. It replaced a previous process in which five or six people would spend up to eight hours each day drawing tanker plans on a whiteboard.
- **Magellan:** Hosted on the Kessel Run platform, Magellan provides an electronic interface for operational planners to allocate mobility aircraft and their associated crews over several months, providing greater visibility and enabling them to de-conflict recurring missions and high-demand periods. Previously, planners were required to use spreadsheets, email, and conference calls – often needing to spend several hours each week to sync information across wings and address overlapping missions. Now the teams can log onto Magellan where aircraft and crew data are updated and synced automatically, saving them significant time.
- **Mattermost**: A collaboration platform for information sharing, collaboration, planning, and repository of historical mission information.
- **PuckBoard**: A software application to plan aircrew qualification flights automatically. The tool, developed by and for Airmen, allows schedulers to rapidly match aircraft commanders, pilots, and loadmasters with available flights to complete currency requirements such as aerial refueling and tactical training events required throughout the year. The application enables planners to visualize flight schedules and generates recommended schedules for each crew member while taking into consideration required qualifications, crew rest, and conflicting events. Previously, the process required Airmen to shuffle 'pucks' around a whiteboard to determine the best match manually – often taking a 10–20-person operations team several days to produce a viable plan for the week, with changes frequently required at the last minute. With Puckboard, events are

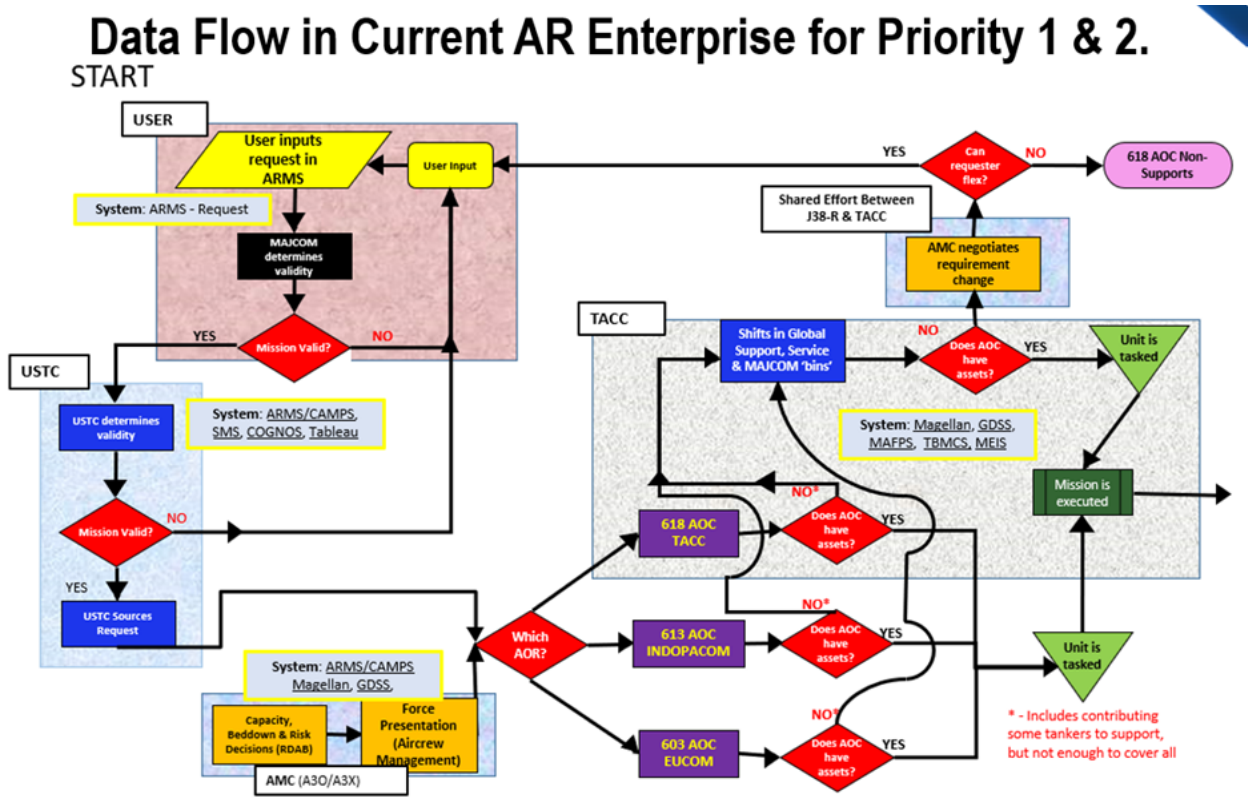
automatically populated in a matter of seconds, allowing planners to dedicate additional time to developing more individualized and dynamic training for each crew member.

- **Pythagoras:** An update to Jigsaw that will enable autonomous planning.
- **RR-AROPS:** The United States Transportation Command ("USTRANSCOM") awarded Rolls-Royce an Other Transaction Authority ("OTA") Prototype Demonstration contract in April 2021 for the Rolls-Royce Refueling Optimization and Planning System ("RR-AROPS"). The purpose of the OTA contract was to demonstrate and evaluate the RR-AROPS system against stated USTRANSCOM needs, aligned with senior leader objectives and directives: "U.S Department of Defense lacks a single platform for common-user requests of air refueling capability required to conduct integrated operations to link air refueling requirements effectively and efficiently with available tanker capacity. USTRANSCOM executes its global air refueling mission utilizing a host of mode and Service-specific systems that do not interface nor give an end-to-end view of capacity utilization or efficient management of a high-demand, low-density resource…USTRANSCOM is seeking to prototype a robust and scalable information technology solution to execute Department of Defense and Federal Government multimodal, worldwide air refueling requirements from user request through mission execution."
- **TBMCS:** Theater Battle Management Core Systems (TBMCS) provides Joint and Service Combat Air Forces with automated Command, Control, Communications, Computer, and Intelligence systems to plan and execute theater-level air campaigns. It is an Air Force lead program with Joint and Allied participation. TBMCS is the theater air module of the Global Command and Control System (GCCS) and includes the Force and Unit Contingency Theater Automated Planning System (CTAPS), Combat Intelligence System (CIS), Wing Command and Control System (WCCS), and the Air Support Operations Center (ASOC) top-level applications. Elements of TBMCS are planned for every theater air command and control and air weapons system from the Joint Forces Air Component Commander to the executing aircraft squadron. The mission of TBMCS at the force level is to provide the Joint and Combined Air Component Commander with the automated tools necessary to plan, monitor, and execute the air campaign effectively and efficiently. This includes planning and issuing the Air Tasking and Air Control Orders that ensure the Theater Commander's intent is supported through the application of airpower using the latest intelligence. TBMCS capabilities should also ensure that air operations are de-conflicted. The mission of TBMCS at the unit level is to provide the Wing and Base Commanders and their battle staff with timely and accurate information for effective decision-making. TBMCS is also supposed to provide a secure, automated, deployable, and distributed Wing-Level Command and Control System with connectivity to force-level TBMCS systems. TBMCS contributes to Joint Vision 2010 by providing information superiority through the integration and distribution of information relevant to the planning and execution of theater air operations. Through the extension of TBMCS to the Navy, Marines, and Army, as well as Allied nations' air forces, integration of joint and coalition capabilities is also achieved. The scalability and modularity of TBMCS supports rapid strategic mobility while the theater airlift application provides connectivity with theater mobility capabilities. One of the TBMCS applications provides an integrated air picture updated from several theaters and strategic sensors and organizations. This integrated air picture, along with the fused intelligence provided by interaction with other Service intelligence systems, supports increased situation awareness. TBMCS is a software-intensive program that incorporates spiral development processes. The near-term version will be replaced with future versions that

incorporate solutions to identified deficiencies as well as add new functionality. The TBMCS program does not currently have a stand-alone requirements document. Instead, the program has a System Version Requirements Document that contains the operational requirements for TBMCS Version 1 and was derived from the legacy system's individual Operational Requirements Documents (ORD). The mission performance requirements in the System Version Requirements Document are grouped into a collection of 45 Mission Critical Functions, of which 19 are mapped to five Key Legacy Functions that define the requirement for the first version of TBMCS. Due to concerns about immature functionality and inter-service interoperability of TBMCS Version 1.0.1, and the USAF plan to field TBMCS prior to adequate operational testing, DOT&E placed TBMCS on the OT&E Oversight List during this evaluation period.

- **The Matrix:** A spreadsheet used by the Tanker Airlift Control Center (TACC) to match requirements to available tankers.
- **Social Media:** Pilots have been using social media to coordinate AR support for priority 3 & 4 missions for quite some time. As most low-priority missions are not approved and allocated for within today’s AR allocation process, airmen have taken to coordinating opportunities amongst themselves.

9. APPENDIX C: Current Priority 1/2 Air Refueling Request Process



10. APPENDIX D: Proposed Air Refueling Request Process

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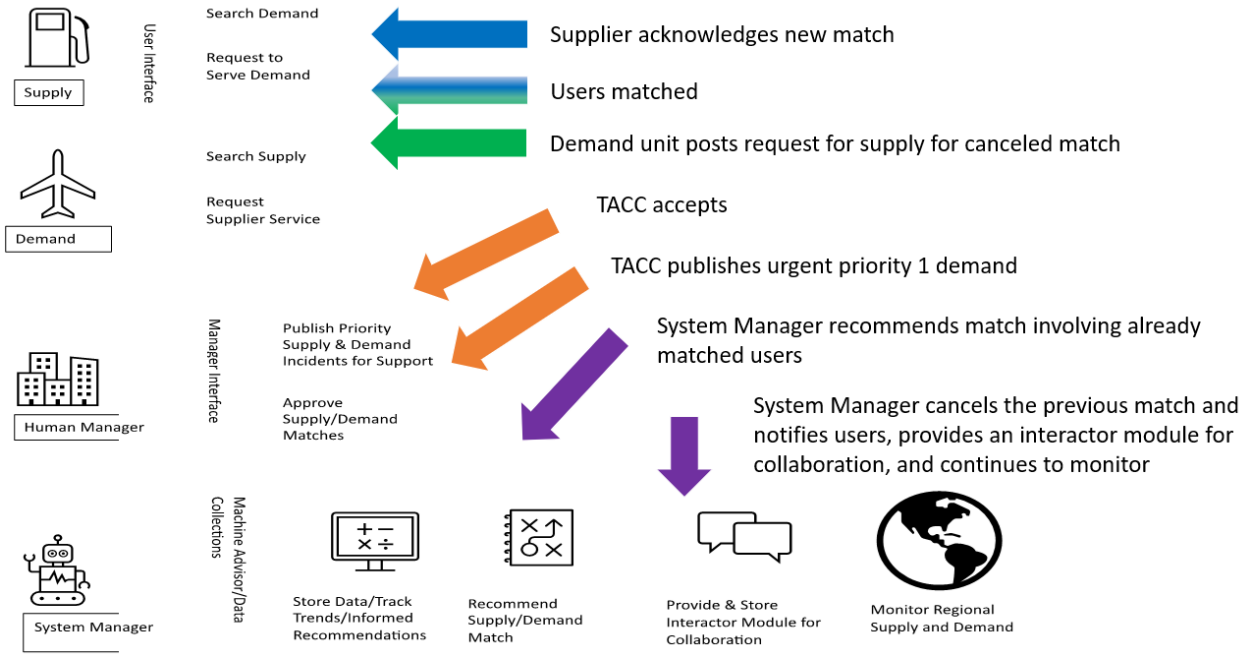
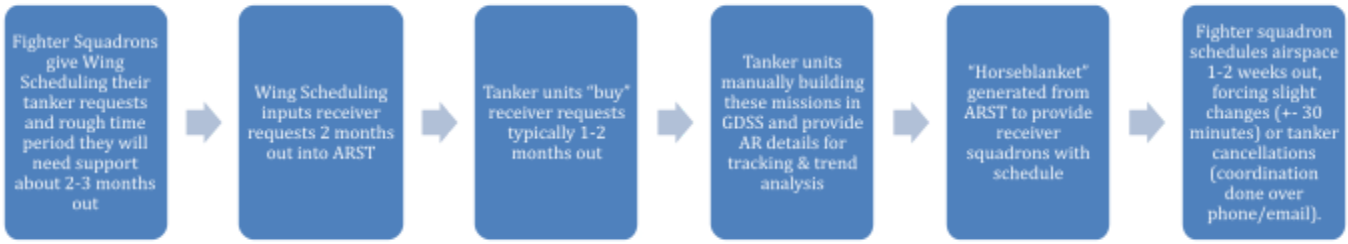


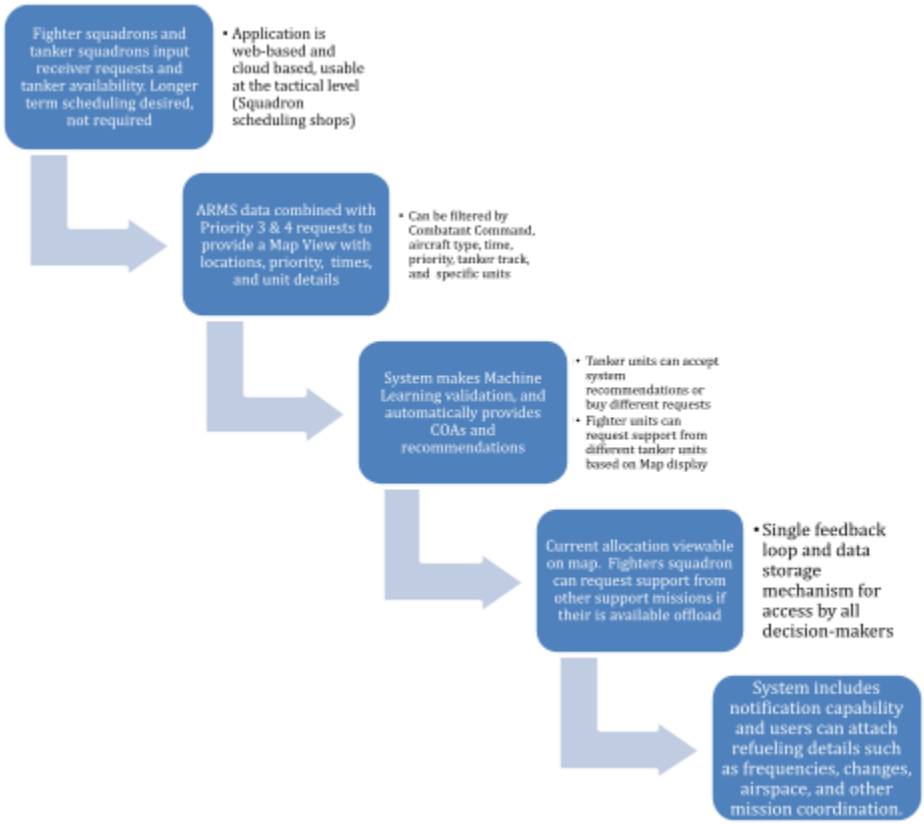
11. APPENDIX E: Current Low Priority Process vs Proposed Solution

Low priority (3&4, or non-ARMS requests) Current Process



- No visibility of Priority 1&2 missions in ARMS to capitalize on remaining offload
- Fighter Squadron's can't see tanker unit availability or their requirements
- No ability to buy multiple requests or share the offload
- Tanker units buy roughly 2 months in advance, but FS typically schedule 1-2 weeks out, so this leads to a disconnect in times and changes to priority (or tanker gets cancelled for higher priority mission that pops up).
- ARST excludes priority 3&4 Coronet missions
- ARST does not include short notice Priority 1 & 2 (inside 30 days)

Solution



Solution Key Features

- Augments ARST AR request processing
- Provides end users with simplified options for AR Request submission
- All requests in ARMS are displayed on map view to show operational picture
    - Extra available offload can be requested from these higher priority missions if situation allows (i.e. post mission completion)
- Entire process is crowdsourced for lower priority missions. All units have access to system to view operational picture, including USTC, MAJCOMs and TACC.
- Data is shared with ARMS and GDSS, providing feedback to AMC leadership on efficiency and fleet effectiveness.
- Data is stored so historical trends and information can be accessed by operations planners

Operations Research Design with Machine Learning

- Create fuel efficiency by matching requirements based on unit locations and refueling tracks available.
- Allow for filtered search by users to specify operating region. This system will default to give visibility of all data within the user's Combatant Command Area of Responsibility (AOR).
    - Search criteria can be filtered down to specific AR tracks, selected states, specific units, or even cross-combatant command for Coronet movements.
- System makes recommendations for matching tanker requirements through machine learning based on historical data and trend analysis
- System acts as "one-stop shop" for execution related information such as frequencies, ARCT, tanker tracks, aircraft types, and any additional coordination needed.

Crowdsourced Decision-Making

- All tanker units with available tankers can accept recommendations made by the system, choose not to accept, or buy other requests.
- Tanker Units can input their own requests and availability, and Fighter Squadrons can use this to search for available units or find a “best” match based on the tanker requirements
- Maximized viewing of requests, availability, and current operating picture will increase opportunities to fill requirements.
- Notification system built in, making this system similar to other messaging platforms in the event of last minute changes.

Question to answer: How does crowdsourcing fix the current problem in the refueling enterprise?