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KEEP ON TRUCKING: AN ENTREPRENEURIAL APPROACH TO INTRATHEATER AIRLIFT

by

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Biography

Lieutenant Colonel Allerheiligen was commissioned in the Air Force in 1992 from the United States Air Force Academy. After 11 years of operational assignments, he completed a staff assignment as Chief of Requirements Branch for the Joint Deployment Process Owner Division, Joint Experimentation and Concept Development Directorate (J-9), United States Joint Forces Command (USJFCOM) in 2006. Following his staff assignment, Colonel Allerheiligen held several positions at Little Rock Air Force Base, Arkansas, culminating as Commander, 50th Airlift Squadron, and Deputy Commander, 19th Operations Group. He also served 5 months at Joint Base Balad, Iraq as Commander, 777th Expeditionary Airlift Squadron, leading the sole C-130E/H squadron within Iraq. Following that tour, Colonel Allerheiligen spent one year on faculty at the Air Command and Staff College where he served as an Instructor and Course Director in the Department of Strategy and Leadership.

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Abstract

As the US Air Force (USAF) completes the drawdown from wars in Iraq and Afghanistan, the reduction of deployments and restructuring of budgets provide a rare opportunity to explore new intratheater employment models. There is potential to maximize the performance of intratheater airlift through the integration of an incentive-based entrepreneurial model for airlift scheduling, decision support, and process control. This paper considers three different distribution systems: the current military intratheater airlift system being executed by US Central Command (USCENTCOM); Walmart's domestic distribution network; and a hybrid system based upon the current intratheater airlift system, but altered to include entrepreneurial incentives and process improvements. Each system is illustrated by how it addresses each of five key factors: (1) incentives, (2) process management, (3) information technology support, (4) approval, validation, and prioritization of cargo, and (5) fleet balancing. The systems are analyzed along customer-focused parameters of responsiveness, flexibility, reliability, and efficiency. In the right circumstances, military leaders can apply natural market forces to military operations without sacrificing the oversight or control needed for emergency situations. Although there are significant cultural barriers to an entrepreneurial approach, the Air Force should develop a system that uses market incentives to improve the tools of the theater distribution system to maximize effectiveness while retaining high levels of efficiency.

Introduction

As the US Air Force (USAF) completes the drawdown from wars in Iraq and Afghanistan, the reduction of deployments and restructuring of budgets provide a rare opportunity to explore new intratheater employment models. While there is no guarantee that the next conflict will resemble the last, a review of current experience and alternative solutions illuminates new capabilities that potentially improve future force employment.[1] One area that must be studied is the management and employment of the theater distribution system (TDS).

The current intratheater airlift system suffers from process efficiency--and in some cases effectiveness--challenges. Customers are left dissatisfied because the system does not meet their expectations of responsiveness, reliability, or flexibility.[2] For the duration of this paper, customer refers to the recipient of a shipment, not necessarily the end-point consumer or the requester of the shipment.[3] While centralized control is absolutely necessary to ensure support for the highest theater priorities, recent US Central Command (USCENTCOM) practices have devolved toward centralized execution, exacerbating bottlenecks in the scheduling process.[4] In contrast, commercial companies work to simultaneously satisfy customer requirements and maximize efficiency across the supply chain.[5] The entrepreneurial mechanisms that push for perfect customer satisfaction while maximizing efficiency provide examples of improvements that can be used within the military distribution system. Undoubtedly, military processes, cultural perspectives, and decision support systems will need to change to apply commercial models to the intratheater airlift process. However, there is great potential to maximize the performance of intratheater airlift through the integration of an incentive-based entrepreneurial model.

This paper examines the current intratheater airlift system and identifies key characteristics. It then reviews Walmart's scheduling and dispatching process. The two systems are then combined to create a hybrid process. Using customer-focused performance metrics of responsiveness, reliability, flexibility, and efficiency, the paper evaluates the three models to determine the relative strengths and weaknesses. Although there are significant cultural barriers to an entrepreneurial approach, the Air Force should develop a system that uses market incentives to improve the tools of the theater distribution system to maximize effectiveness while retaining high levels of efficiency.

System Descriptions

This paper considers three different distribution systems: the current intratheater airlift system as it is currently being executed in USCENTCOM; a commercial entrepreneurial system based upon Walmart's domestic distribution; and a hybrid system based upon the current intratheater airlift system, but altered to include entrepreneurial incentives and process improvements. The key components of each system are: (1) incentives, (2) process management, (3) information technology support, (4) approval, validation, and prioritization of cargo, and (5) fleet balancing. A summary of the three systems is provided in Table 1.

Table 1. Transportation System Comparison

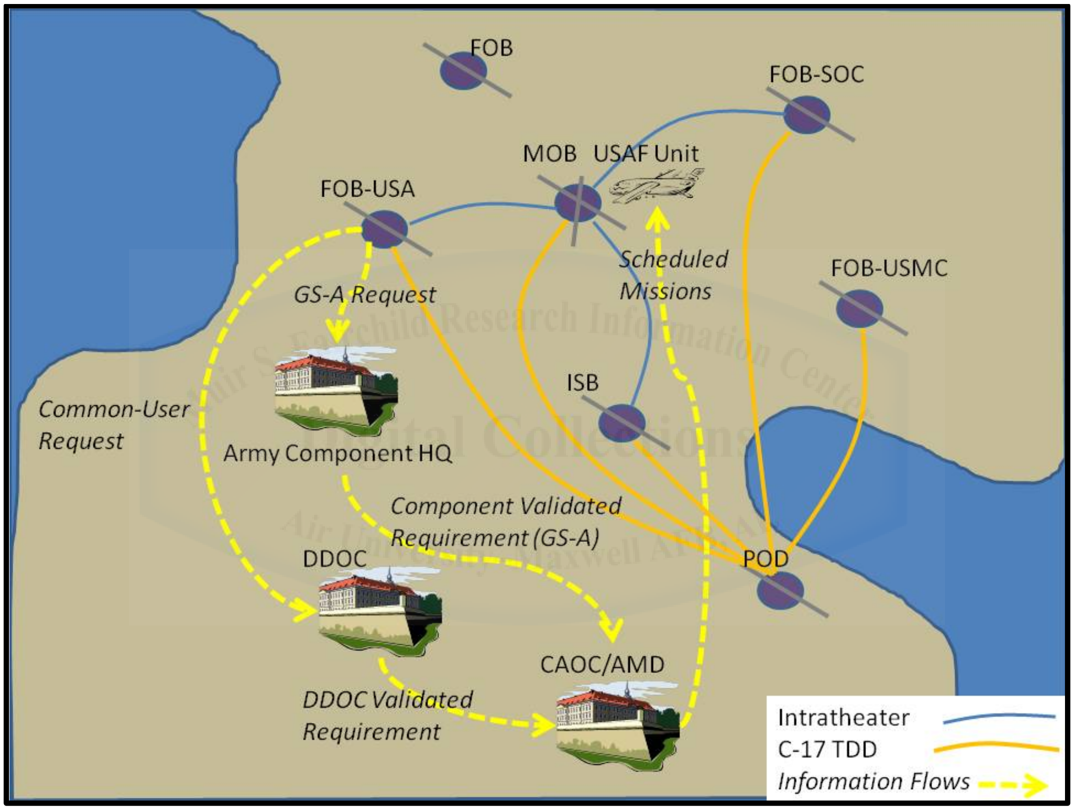
	Military TDS	Commercial	Hybrid
Incentives	"Mission first" or effectiveness; efficiency when you can; military rank is used to influence the process	Market pressures: Competition, profitability, market share, risk reduction	Mission first + incentivized system
Process Management	Centralized control; centralized execution; senior officer approvals	Centralized planning; decentralized control and execution: Distributed management with extensive decision support; local manager approvals	Centralized control & oversight/decentralized execution: Limited decentralized planning with tactical units as brokers & consolidators; approvals at lower levels
IT Support	Complicated and incomplete set of systems forces management through manual processes such as spreadsheets	Electronic information exchange; web-accessible bidding; robust decision support; exquisite in-transit visibility of goods	Integrated system of systems to eliminate manual data entry; visibility and accessibility to operators and users alike
Validation	Laborious validation & prioritization by senior command levels, may take 72 hours (then 48 to schedule); certain arrangements delegate validation to user	Validation is performed by shippers when they pay the cost; prioritization is shipper's responsibility. Premium service increases the costs.	Pre-validate certain requirements; allow trusted users to validate own requirements; self-regulation of demand
Fleet Balancing	No access or visibility of component assets; some commercial channels w/in theater (tender); outsource to C-17 for surge ops	60% of fleet is owned, 40% outsourced; plus hire-out of fleet to increase revenue	Outsource to other service components for common user requirements

The Intratheater Airlift System: A Centralized Control System

The intratheater airlift portion of the TDS (Figure 1) is centrally planned and controlled by the Air Mobility Division (AMD) of the Combined Air Operations Center (CAOC).[6] The AMD is charged with coordinating the common-user fixed wing assets to support the Joint Force Commander's (JFC) requirements as directed by the Joint Force Air Component Commander

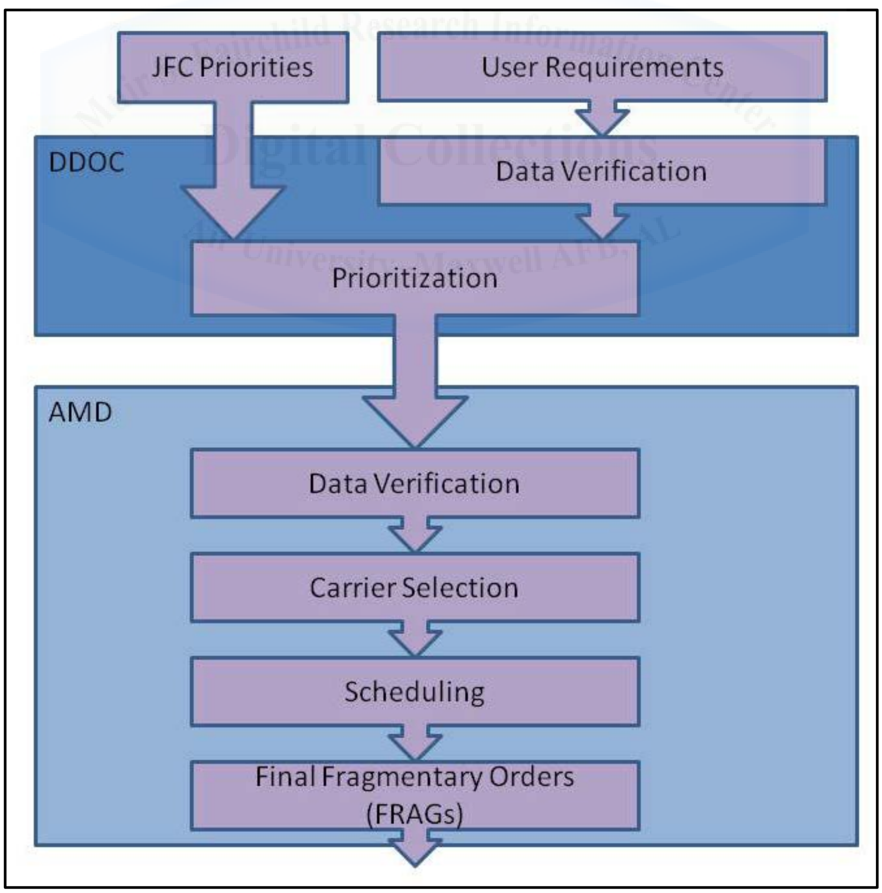
(JFACC).[7] Under steady state conditions with predictable requirements, the AMD is effective at creating schedules that maximize customer support while efficiently using the available assets. According to Maj Blane Rasch, former Chief, Airlift Control Team in the AMD, when the requirements are dynamic, short notice, or highly variable, AMD's limitations constrict the system's responsiveness and flexibility.[8]

Figure 1. Military Theater Distribution System (TDS)



The distribution process begins with users identifying their transportation requirements. The users feed their requirements up the chain of command to the component headquarters. The component headquarters aggregates the requirements and passes them to the Deployment and Distribution Operations Center (DDOC) for validation. According to JP 3-35 *Deployment and Redeployment Operations*, "requirements validation confirms the need for the movement requirement and provides detailed shipment data."[9] As the DDOC validates the movement requirements, it also prioritizes shipments based upon the JFC's guidance—a challenging task when there are more requirements than available lift (Figure 2).[10] Because the components do not pay for their transportation, there are few practical constraints to what they request.[11] DDOC planners act as honest brokers and may deny or delay some requests satisfy higher priorities.[12] Still, rank and personalities drive the operation more than the written process or numerical analysis of effectiveness and efficiency, so high ranking senior officers may occasionally ask planners to bypass the normal process.[13] Validation takes 2-3 days to complete.[14] Once the shipments are consolidated, validated, and prioritized, the DDOC passes the movements to the AMD for scheduling and dispatch.[15]

Figure 2. Summary of Validation and Scheduling Processes



After receiving the transportation requirements from the DDOC, the AMD seeks to consolidate shipments and routes while it concurrently works to determine the best aircraft for each shipment.[16] The AMD has several carrier choices, to include: C-130s under the Air Force component control, the C-17 for theater direct delivery (TDD), or a tender contract with a commercial carrier.[17] In TDD missions, C-17s take cargo and passengers directly from theater ports of debarkation (PODs) to forward operating bases (FOB) and other destinations, bypassing the usual intermediate distribution hubs used by the C-130s.[18] In essence, the AMD outsources its requirements to US Transportation Command (USTRANSCOM), just as it does with other commercial carriers.[19] This outsourcing enables the AMD to increase capacity for surges, as well as reduce the logistics footprint for aircraft deployed to the theater.[20]

There is still a lot of intratheater airlift that the AMD does not manage. According to Colonel Charles Howard, Chief, Strategic Deployments Division at USCENTCOM: "Of the theater assigned airlift aircraft, only 45% are fully AMD controlled."[21] Similarly, the AMD has no control over rotary lift, special operations assets, or Army, Navy, and Marine Corps fixed-wing transports.[22] Those components receive direct support from their aviation arms and have no incentive to offer their excess capacity to benefit the AMD.[23] Because the service components are only required to share minimal data with the AMD for deconfliction of the airspace, shippers do not have full visibility of all the assets that they might be able to use.[24] Without visibility or access to all available assets, the AMD has limited ability to "improve effectiveness, increase joint synergy and minimize duplication of effort."[25]

Once a validated requirement is received by the AMD, it typically takes 48-hours to get an aircraft scheduled to service that lift request.[26] Because this process takes up to 5 days from request to actual shipment,[27] shippers complain the centrally managed TDS is not sufficiently responsive to meet their time-sensitive/mission critical (TS/MC) requirements.[28] When supporting dynamic and urgent operations, Army planners may not have the ability to completely plan their operations 5-days in advance, nor the luxury of waiting 5-days for critical resupply.[29]

A major impediment to reducing the time required to validate and schedule aircraft is the lack of an integrated information technology (IT) solution to support intratheater airlift planning and execution. There are over 15 different joint and coalition systems designed to track and manage requirements and movements of theater passengers and cargo.[30] Because the theater airlift system does not have a single tool for capturing, consolidating, or prioritizing requirements, the work is input manually onto spreadsheets, referred to as fragmentary orders or FRAGs.[31] Those FRAGs then become the source documents for route planning, scheduling, and flight following--generating a huge manpower burden to manage each and every movement. Non-standard missions or special requests consume up to 10-times more manpower to plan than a standard mission.[32] Thus, the AMD manpower becomes a choke point in the process.[33] Because of the high workload needed to generate a change to the plan, AMD operators are hesitant to make changes.[34] Priority or requirement changes often require senior officer approval in the AMD, which requires a similarly ranked officer to make the change request.[35] With sufficiently high-ranking officers pushing the process, they may negotiate some short-notice requirements, but having to do so only decreases the customer's perception of the system's responsiveness.[36]

To address the Army's TS/MC requirements, the Air Force agreed to provide more direct support to the Army. Recent arrangements used direct support-apportioned (DS-A) to specific units or general support-apportioned (GS-A) to an entire service component, depending upon the joint operations area.[37] Regardless of the designation, the concept is the same: the AMD reserves one or more missions for a service component without having the requirements go through DDOC validation.[38] In the DS-A/GS-A process, most of the validation process is decentralized to the component requesting the lift.[39] The AMD fills any unused capacity, whether in terms of cargo space or available crew duty day, to maximize the aircraft and the crew's day—thereby gaining some efficiencies and benefits of centralized control while giving priority service to certain customers.[40] If there is good cooperation between the user and the AMD, the end result can be as efficient as a fully controlled AMD line.[41] In fact, the GS-A concept recently increased lift efficiencies 35% while still achieving 100% of the user requirements.[42]

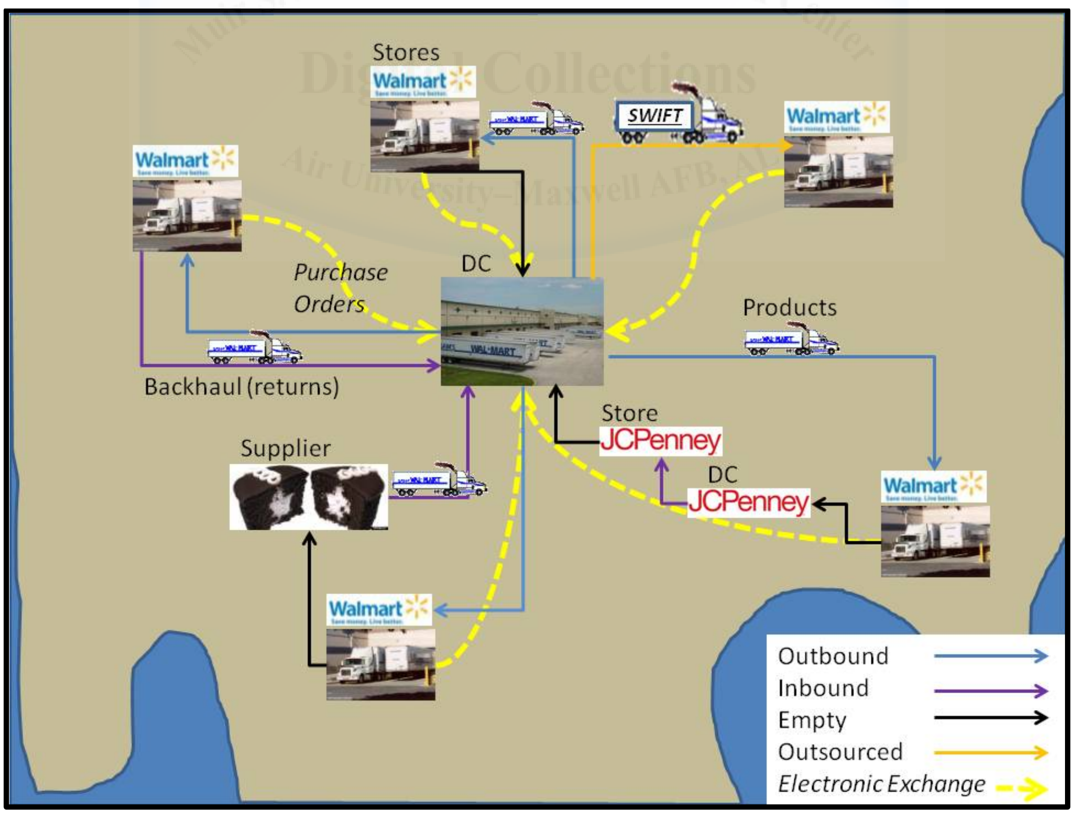
Theoretically, the execution phase—the dispatch of aircraft and actually flying of missions—is decentralized to local authorities (i.e. the flying units).[43] With improved communications, AMD execution has shifted toward a more centralized approach.[44] While communications improvements enable great agility for dynamic re-routing of the aircraft, they are also used to divest the unit and aircraft commanders from decision authority normally implied with decentralized execution.[45] Even if shippers had the authority to do real-time shipment consolidation, they are unable to take advantage of unused capacity because they do not have any visibility into what excess capacity is available.[46] While centralized execution orchestrates the system for reliability, there are inefficiencies because of the choke point created by the AMD.

In summary, the intratheater airlift system has proven highly effective and generally efficient, but adoption of commercial techniques can provide improvements. The highly centralized functions of the AMD stifle creativity and flexibility because its decision support is highly fragmented, and its manual processes are not conducive to dynamic, variable requirements.[47] GS-A/DS-A construct offers some balance between customer support and efficiency, but there are additional improvements available through adopting applicable practices from a commercial motor carrier model.

Commercial Motor Carrier Operations: An Entrepreneurial Network

The commercial motor carrier (trucking) industry is a large and complex network of vendors, retail operations, suppliers, shippers, third-party logistics operators, and vehicle operators. This system uses market forces to provide shippers and carriers maximum flexibility, efficiency, and customer-focused performance. Commercial operations are highly decentralized in both control and execution.[48] Each firm or stakeholder will either control or sub-contract their planning and scheduling processes.[49] Stakeholders are pressured to be efficient by the forces of competition, yet they must all remain effective in order to stay in business.[50]

Figure 3. Commercial Distribution Example: Walmart



As one of the world's largest corporations, Walmart provides a good example of an entrepreneurial logistics system (Figure 3). Like the deployed Air Force component, it is a fleet owner, a distributor, and a retail location operator.[51] While Walmart uses trucks, the AMD schedules aircraft as the primary delivery platform. Walmart uses large distribution centers (DC) to support the stores; these are analogous to the PODs and main operating bases (MOB) that the AMD uses. The points of sale for Walmart are its stores; whereas the Air Force uses intermediate staging bases (ISB) and FOBs as points of consumption.

Mr. Chris Kozak, Transportation Director for Walmart, described the Walmart distribution system as centrally planned, de-centrally controlled and de-centrally executed. Fleet planning, contracts, and route planning are done centrally—with great success. Through creative routing, scheduling, and sub-contracting of some routes to other carriers, Walmart reduced empty truck miles by 10% over the last 3 years.[52] The 160 DCs perform the control and execution of movements within their region, each servicing 150-160 stores.[53] The DC's manage the transportation, while the stores manage their requirements, passing them to the DC for servicing.[54] For example, if a store has an urgent need for additional stock, the store's stock manager simply calls the DC to get additional items on the next truck headed to the store. The store has visibility on what is on each truck before it ships, so they temper their requests to the available space.[55] This process flexibility and responsiveness is driven by trust, visibility, and delegation of authority to the appropriate level.

The Walmart supply chain is supported by extensive information technology (IT). The restock requests and purchase orders are consolidated at the DC and shipped daily via one of the four trucks per store per day from the DC; one each of general merchandise, groceries, dairy, and meat products.[56] Manifesting, billing, and planning data are all tied into the same network of systems, enabling Walmart executives to perform detailed advanced planning and fleet management. In a free market system, prioritization is sorted out through competitive pricing—there is no master list of who gets serviced first. Carriers shift their fleet to service the best customers. Shippers gain priority service by paying for premium service.[57]

Walmart balances its capital risks by not owning all of its transportation capacity. Walmart's fleet of 6,200 tractors and 60,000 trailers deliver about 60% of its cargo from the DCs to the retail stores. The remainder of the steady state requirement, as well as a surge capacity, is outsourced to freight carriers such as Schneider International and Swift Transportation. Also, Walmart hires out its fleet to do business for other retail operators, such as JC Penny, in order to recuperate costs associated with returning the trucks back to the DCs for another pickup.[58]

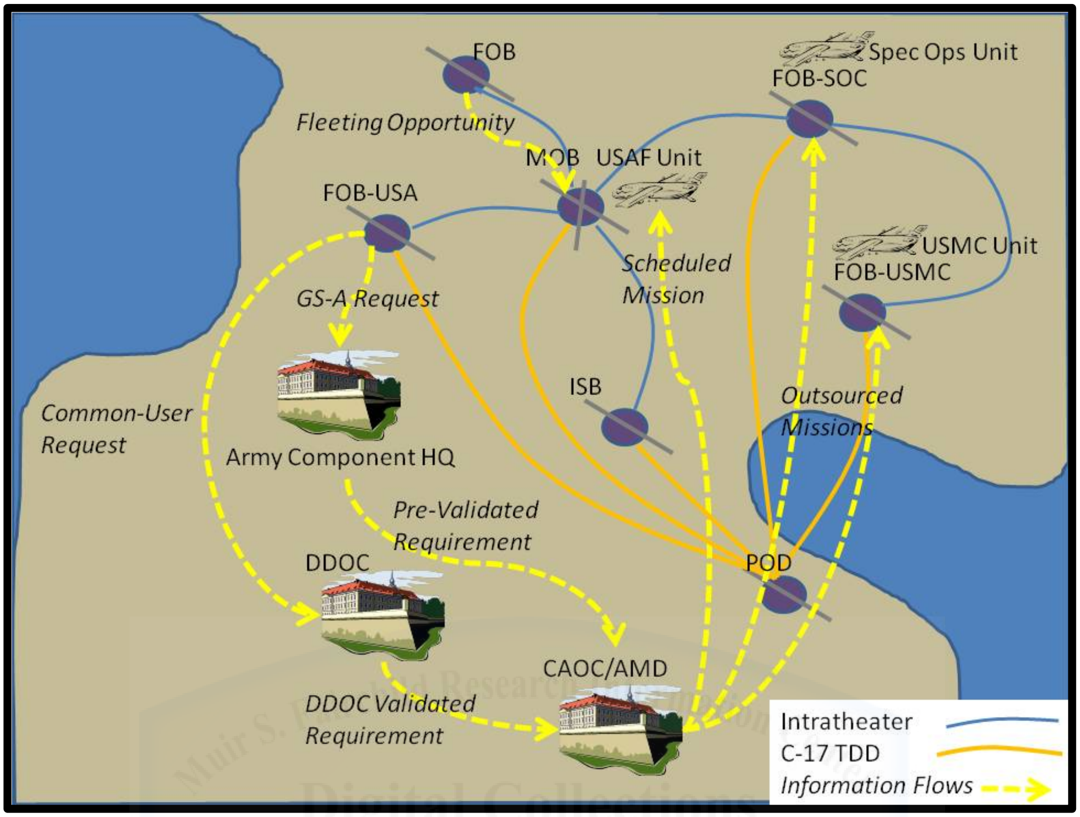
Walmart's techniques are extremely effective in reducing logistics costs. Over the last 5 years, they delivered 361 million more cases of product while driving 250 million fewer miles than the previous 5-year period.[59] Their key practices include delegating scheduling to the DCs, excellent electronic visibility of demand and goods en route, an insatiable pursuit of meeting 100% of the demand for the least cost, creative routing and scheduling to reduce empty truck miles, and exquisite coordination with sub-contractors.[60]

In the aggregate, the industry behaves as a dynamic network, creating and reinforcing transportation routes in accordance with market pressures, yet finding ways to service all customers.[61] Market pressures such as pricing and competition work to incentivize operators to respond to demand. Because of the competition, the network drives customer-focused performance.[62] Competition between carriers and brokers demands efficiency, allowing for higher profit margins or lower prices for the customers. Ultimately, the customers determine the definition of effectiveness by "voting" with their money.

Hybrid Intratheater Model: Incentivized Decentralization

Mobility airlift has a long history of applying commercial processes to gain improvements.[63] The applicability of commercial methods to the military mission depends upon systemic, equipment, and network design differences. Generally speaking, supply chains and decision support systems are highly integrated in the commercial sector, which enables centralized planning and decentralized control and execution of logistics. The following model seeks to balance the benefits of a commercial model in terms of efficiency *and* customer satisfaction while applying feasible policy, technology, and process changes to the military model. At the high level, the proposed model is largely the same as the intratheater model, with a few modifications to create the basis of an entrepreneurial network. Rather than describe all of the processes in detail and then do a comparison, this discussion will focus on the differences from the current intratheater airlift system created by including an entrepreneurial incentive system (Figure 4).

Figure 4. Hybrid Entrepreneurial System



The most revolutionary, yet the most culturally difficult change, is to modify the very incentives that form the basis of the military culture. Because of the high value placed upon preserving the lives of our soldiers and the desire to maximize effectiveness in any given situation, military systems and processes are designed to value effectiveness over efficiency.[64] The Transportation Working Capital Fund (TWCF) provides a model for how to develop monetary-based incentives into a government system. The TWCF was developed to provide readiness, responsiveness, and reliability to the Defense Transportation System (DTS) during times of crisis.[65] Because USTRANSCOM must respond to international crisis before funding is approved by Congress, the TWCF serves as a buffer until funding is available.[66] Because of the need to capture the cost data associated with the use and management of TWCF, USTRANSCOM and its components become very aware of the business costs and use that cost data to generate efficiencies while remaining fully effective.[67] Because DTS users have limited operations funds to spend on transportation needs, their demand for transportation is self-regulated.

Implementing a system similar to TWCF for theater operations could provide incentives for effective and efficient operations. With clear cost data available, operators could readily evaluate their performance to determine if their efforts are generating the desired effects while maximizing efficiency. If shippers are limited by budgetary constraints, they will be naturally incentivized to limit their request for premium (i.e. air) service to the minimum necessary for mission accomplishment. Cost data would also expose components and units who are over-reliant on airlift to support their sustainment needs.[68] A fee-for-service system could also incentivize other components to participate in common-user lift. If the components get tangible benefits in return for their efforts, they are more likely to extend additional capacity to the common user pool. Use of premium pricing would enable theater managers to direct the network's behavior to create the desired prioritization, responsiveness, and efficiencies.

To take advantage of fleeting tactical opportunities, the hybrid system requires limited decentralization of control and execution. [69] As shown in the commercial model, this decentralization could take several different forms. One way is to allow tactical units to act as shipping brokers to fill unused capacity not directed by the AMD. This has already been done as a proof of concept during test of the 2009 TS/MC Concept of Employment (CONEMP).[70] Likewise, this concept proved very effective when Joint Base Balad F-16s used residual fuel to perform armed over-watch.[71] In a similar manner, airlift squadrons could add-on local moves for opportune cargo or passengers, or keep the planes down for additional maintenance, or even await additional cargo to improve load efficiency.[72] The key to delegation is transferring authority to the tactical units, allowing units to service a customer's requirements.[73] There must be trust and discipline in the system so the AMD can identify a valid change requirement without senior officer intervention.[74] The suggested hybrid system allows trusted customers to validate their requests at the "manager" level—usually a company-grade officer (CGO).[75] In return, the user needs to accept the decisions made at the same level within the AMD—usually a CGO or above.[76]

Even without these policy or process changes, there needs to be a fundamental re-look at the IT support to the intratheater airlift processes.[77] In order to increase effectiveness or efficiency, the information available to shippers, carriers, and customers needs to be visible, reliable, reputable, and accessible.[78] Units must have access to open requirements in order to act as brokers in the process.[79] Similarly, if customers and brokers are given visibility into available capacity, they can work their requirements into already scheduled missions to facilitate consolidation.[80] Shippers also need to receive clear confirmation of a scheduled aircraft as soon as it is booked in order to prevent secondary or "just-in-case" bookings by alternative means.[81] Once able to reduce the extensive manpower burden on the AMD, this IT integration will free the AMD planners and controllers to address dynamic changes and to flexibly respond to customer needs. In order to achieve decentralized control, the AMD's processes need to be seamless and effortless so that they are no longer a bottleneck in the process.[82]

With trusted customer relationships, there is an opportunity for pre-validating certain customer lift requirements. This is a process extension of the GS-A/DS-A concepts already being employed.[83] Within a limited set of parameters, the requirements from regular customers should bypass the validation process and move straight to prioritization and scheduling. For example, the Air Operations section (J-33Air) at United States Forces-Iraq (USF-I) acted as the consolidator and validator for the GS-A missions in Operation IRAQI FREEDOM (OIF), removing the DDOC process from the system and allowing for a 48-hour turn time from request to scheduled aircraft.[84] Having additional user groups organically validate and consolidate further reduces AMD workload and enables better support to all customers.

A final modification is the assimilation of other components into the common-user airlift equation. Special operations, Army, Marines, and Navy components all own and manage organic fleets that could support other customers. At this time, there is no incentive for a commander, other than professional trust, to release his or her organic assets to support another component.[85] The costs associated with supporting another component are real in terms of service-borne costs of manpower, logistics, and life-cycle maintenance.[86] If there was a means of remunerating other components to assist with the theater distribution process, additional responsiveness, reliability, and capacity would be available for all to enjoy. USTRANSCOM has already demonstrated an effective process for hiring out C-17s to support theater missions, with good results for both theater and global managers.[87] In the same manner, the AMD could outsource requirements to increase the capacity of the theater system and increase overall system responsiveness without having to deploy additional assets.[88]

Analysis

According to Bowersox et al. in their book *Supply Chain Logistics Management*: "While in some ways it's an insight into the obvious, it is important to establish initially that logistics contributes to an organization's success by accommodating customers' delivery and availability expectations and requirements."[89] In order to analyze a distribution system, the customer's perspective is paramount. They continue to say, "regardless of the motivation and delivery purpose, the customer being serviced is the focal point and driving force in establishing logistical performance requirements."[90] According to JP 4-0, *Joint Logistics*, "the effectiveness of joint logistics can be measured by assessing the following attributes…speed, reliability and efficiency."[91] To provide commonality with civilian supply chain lexicon, this paper substitutes the terms reliability and flexibility in lieu of speed. The following definitions are derived from Bowersox et al.:

1. Responsiveness: Ability of the carrier to meet the "customers' expectations of the willingness and ability of the carrier to provide prompt service."[92]
2. Reliability: Ability to "meet requirements at agreed upon time"; ability to "provide accurate information to customers regarding operations and order status."[93]
3. Flexibility: "Ability to accommodate special situations and unusual or unexpected customer requests."[94]
4. Efficiency: "Measure of resource expenditure necessary to achieve…logistical effectiveness."[95]

Each model was analyzed along these four parameters to determine its relative performance with respect to the other models. A summary is provided in Table 2.

Table 2. Summary of Comparative Analysis

	Military TDS	Commercial	Hybrid
Responsiveness	Long validation timelines degrade customer service; manual processes bog-down decision making; centralized execution and high decision levels reduce responsiveness	Highly responsive to customer desires; anticipatory service; customer service decisions delegated to appropriate levels	Reduced validation timeline improves responsiveness; increased capacity increases ability to support; decentralized execution enables additional levels of service
Reliability	Centralized control enables asset pooling; no access to other components limits amount of assets to share; limited visibility into other components reduces options	Trucks are intrinsically reliable compared to aircraft; with large delivery windows, it's easier to meet requirements; reliability is part of the contracted customer service	Increased fleet enables more options; better visibility increases options; decentralized decision making can take advantage of fleeting opportunities
Flexibility	Willing to take great risk to meet mission requirements; may require senior officer intervention to accept high risks	Fiscal constraints will restrict flexibility; system is geared toward predictability and reliability	Willing to take great risk to meet mission; decentralized decision making takes advantage of fleeting opportunities or local circumstances; better visibility increases options
Efficiency	Efficiency is limited by poor decision support; manual processes to maximize load factors; willing to sacrifice efficiencies to improve responsiveness	Superb decision support enables great improvements in route efficiency; flexible scheduling and contracting reduces empty miles; excess trailers keep tractors moving	Improved decision support aids in improving route efficiencies; better asset and load visibility improves load factors; costing data highlights opportunities for improvement

The commercial model will almost always be the most responsive. In the military TDS, long validation times reduce customer service. The manual processes employed by the AMD reduce its ability to address changes to customers' requirements. The approval process to change missions, often requiring senior officer engagement, slows the TDS response and tends to aggravate customers. For the commercial model, competitive marketing campaigns seek to create and meet demand before customers even cognitively know they have a need. Commercial firms are able to do more than respond to demand; they anticipate it.[96] Managers delegate decision making for customer service issues to the lowest possible level, enabling quick response to customer needs. For the hybrid model, reduced validation timelines and decision making at the AMD will reduce customer wait times. Increased access to component airlift assets increases the hybrid's effective capacity, allowing for increased customer service. Finally, decentralizing decision making improves customer service by allowing tactical units to serve as brokers to satisfy local requirements.

The reliability for all three models is very high. The centralized execution of the military TDS enables the AMD to dynamically reroute missions to minimize losing any routes due to mechanical or operational impediments. The military TDS's reliability is constrained because the AMD does not have visibility or access to the full complement of airlift assets in the theater. If the pool was larger, then the AMD could increase reliability. The commercial system will generally be highly reliable because trucks are intrinsically more reliable than aircraft. [97] Also, drivers are given large delivery windows, making it easier to meet the requirements.[98] Finally, commercial operators have a financial imperative to be reliable because reliability standards are written into many contracts.[99] The hybrid system, with access to the full array of theater airlift assets, has increased options to deal with mission delays or cancelations. Visibility into the full range of missions allows the AMD to pick any asset to dynamically fill gaps.[100] Delegation of some authority to tactical levels enables units to take advantage of fleeting opportunities to meet customer requirements.[101]

The flexibility of the military system could be the highest of all three models with one caveat: it depends upon who is asking for support. Military aviators are willing to go to great lengths, even risking death, to complete some missions. Senior officers retain the authority to make such risk decisions, but will do so if the payoff is great enough. This flexibility is what creates heroes in wartime and fosters great esprit de corps. In commercial systems, fiscal constraints and contracts limit flexibility. Commercial operations are generally designed for predictability and reliability. Few commercial operators will risk losing equipment or personnel to complete a route.[102] The hybrid system retains willingness to accept risk for mission accomplishment, but includes decentralized decision making to take advantage of fleeting opportunities or local circumstances.[103] Additionally, with better visibility into the full gamut of available airframes, the AMD has more options to choose from to meet unusual or unique requirements.[104]

In this discussion, carrier efficiency is evaluated based upon the dispatcher's ability to keep the equipment moving with high load factors.[105] The load factor is the proportion of the total cargo hold that is filled with revenue generating passengers and cargo. Efficiency is maximized when the equipment is full and moving most of the time. In the military TDS, efficiency is limited by the AMD's poor decision support. The AMD planners work manually to consolidate and aggregate shipments to increase load factors, but accept some inefficiency in order to improve responsiveness and schedule predictability.[106] With predictable demand and extensive decision support, commercial firms are able to use complex decision support software to create highly efficient routes.[107] Additionally, carriers seek to string together revenue generating routes in order to minimize empty miles.[108] They also purchase additional trailers to allow the tractors to keep moving without having to wait to load/unload the trailers.[109] In the hybrid system, improved decision support will enable the AMD to dynamically create legs optimized for effectiveness and efficiency.[110] Visibility into assets and requirements allows for increased load factors and a reduction of lift redundancy.[111] Finally, awareness of cost data, like what is seen in the TWCF managed intertheater airlift system, allows operators and users alike to make better efficiency decisions.[112]

Centralized control can only maximize utilization of the assets when the managers enjoy sufficient time, manpower, priority, and energy to do so. Integrated IT is a key enabler to reduce workload and provide better decision support. Delegation of authority in execution enables increased flexibility and response to local conditions. Market incentives provide the means to increase the pool of available resources, and when coupled with improved IT, create a dynamic entrepreneurial network to achieve near-perfect customer support while gaining great efficiencies.

Conclusions

If implemented as envisioned, the hybrid model has the potential to significantly increase the performance of intratheater airlift operations. Some of the incremental improvements, especially with regard to information technology, were highlighted in interviews and Air Force Lessons Learned reviews as being able to immediately improve the current system without any additional process or structural changes.[113] Decreasing centralization is advantageous provided it is balanced with overall system performance.[114] Military leaders can apply natural market forces to military operations without sacrificing the oversight or control needed for emergency situations. Some decentralization, especially in execution, is desirable because it enhances flexibility and effectiveness by authorizing tactical commanders to take advantage of fleeting opportunities and local conditions. An incentivized system with a corresponding shift in culture can enable an entrepreneurial response to create a dynamic, responsive network that will anticipate customer needs and proactively change to ensure maximum effectiveness, and efficiency.

To experience the potential benefits of an entrepreneurial approach to theater distribution, additional experimentation, modeling, and analysis is required. Specifically, military operators need to develop the right set of processes, benchmarks, decision support, and tracking mechanisms to allow for additional data collection in a contingency environment. Additionally, senior decision makers, especially in the Air Force, must see the benefits and risks of letting tactical commanders make decisions based upon local conditions without gaining buy-in from the centralized control agency first. Finally, processes, mechanisms, and concepts for incentivizing components other than the Air Force to participate in common-user lift must be developed and evaluated before implementation.

The ultimate purpose of the theater distribution system is to help win our nation's wars. To that extent, effectiveness will always supplant efficiency. What we routinely observe is that the most effective operations are also highly efficient.[115] Improving efficiency will increase the capacity of the system given a fixed number of assets. It is in the customers' as well as the carriers' best interest to develop highly efficient operations that maximize the utilization of all available assets. Just as in commercial operations, proper incentives encourage new solutions to maximize effectiveness while steadily increasing efficiency. It is not a matter of either-or, but rather a matter of both-and: increase efficiency in order to maximize effectiveness.

Glossary

Abbreviations and Acronyms

AFDD	Air Force Doctrine Document
AMD	Air Mobility Division
ATO	Air Tasking Order
CONEMP	Concept of Employment
CAOC	Combined Air Operations Center
C2	Command and Control
DDOC	Deployment and Distribution Operations Center
DS-A	Direct Support – Apportioned
DC	Distribution Center
FOB	Forward Operating Base
FRAG	Fragmentary Order
GS-A	General Support – Apportioned
IT	Information Technology
ISB	Intermediate Staging Base
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JP	Joint Publication
MOB	Main Operating Base
OEF	Operation ENDURING FREEDOM
OIF	Operation IRAQI FREEDOM
POD	Port of Debarkation
TDD	Theater Direct Delivery
TDS	Theater Distribution System
TS/MC	Time Sensitive/Mission Critical
TWCF	Transportation Working Capital Fund
USCENTCOM	United States Central Command
USF-I	United States Forces – Iraq
USTRANSCOM	United States Transportation Command

Definitions

Carrier	An individual or company engaged in the transportation of passengers or cargo.
Customer	The recipient of a product or service.
Direct Support	A mission requiring a force to support another specific force and authorizing it to answer directly to the supported force's request for assistance.
Efficiency	Measure of resource expenditure necessary to achieve logistical effectiveness.
Empty Truck Miles	Mileage driven by a motor carrier without any cargo aboard. Also referred to as “empty miles.”

Flexibility	Ability of a carrier to accommodate special situations and unusual or unexpected customer requests.
Intertheater Airlift	The common-user airlift linking theaters to the continental United States and to other theaters as well as the airlift within the continental United States. The majority of these air mobility assets is assigned to the Commander, United States Transportation Command. Because of the intertheater ranges usually involved, intertheater airlift is normally conducted by the heavy, longer range, intercontinental airlift assets but may be augmented with shorter range aircraft when required.
Intratheater Airlift	Airlift conducted within a theater. Assets assigned to a geographic combatant commander or attached to a subordinate joint force commander normally conduct intratheater airlift operations. Intratheater airlift provides air movement and delivery of personnel and equipment directly into objective areas through air landing, airdrop, extraction, or other delivery techniques as well as the air logistic support of all theater forces, including those engaged in combat operations, to meet specific theater objectives and requirements. During large-scale operations, US Transportation Command assets may be tasked to augment intratheater airlift operations, and may be temporarily attached to a joint force commander.
Load Factor	The proportion of the total cargo and passengers to the total available capacity for cargo and passengers; usually represented as a percentage of the maximum capacity for that leg.
Shipper	Person, company, or their agent who prepares an item for shipping; the one who contracts a carrier to haul goods.
Reliability	Ability to meet customer requirements at agreed upon time; ability to provide accurate information to customers regarding operations and order status.
Responsiveness	Ability of the carrier to meet the customers' expectations of the willingness and ability of the carrier to provide prompt service.
Validation	Execution procedure used by combatant command components, supporting combatant commanders, and providing organizations to confirm to the supported commander and United States Transportation Command that all the information records in a time-phased force and deployment data not only are error free for automation purposes, but also accurately reflect the current status, attributes, and availability of units and requirements.

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography).

1. In this context, force employment refers to the management and use of the intratheater distribution assets such as mobility aircraft and logistical vehicles. Sustainment of the entire deployed force is the employment mission of mobility and logistics forces.
2. This is the age old roles and missions debate: All customers want premium dedicated service available at all times without regard to the impacts to other customers. There are mountains of evidence for both sides of the argument dating back to WWI.
3. Bowersox et al., *Supply Chain Logistics Management*, 67.
4. Brown, *Divergent Paths*, 3.
5. Bowersox et al., *Supply Chain Logistics Management*, 3.
6. AFDD 3-17, 6.
7. For all practical uses, the common-user assets are Air Force C-130s and limited C-17s. Rarely will another component release their organic lift to suit common-user requirements.
8. Maj Blane Rasch (Chief, AMD Airlift Control Team, August 2009-August 2010), interview by the author, 11 December 2012.
9. JP 3-35, xii.
10. DuHadway, *Reengineering Air Mobility*, 40.
11. AFDD 1, 57: When intratheater aircraft deploy (i.e. C-130's), their operations are funded by their service i.e. US Air Force. JP 4-0, 67: "A [Combatant Commander's] directive authority does not discontinue service responsibility for logistic support." JP 1-06, I-5: The customers establish the mission requirements; the transportation providers fund the movement without gaining reimbursement from the user.
12. Devereaux, *Theater Airlift Management and Control*, 5-6.
13. Brown, *Divergent Paths*, 17. Senior leaders have directed that they retain decision authority over significant portions of the airlift system, as well as the prerogative to deviate from established doctrinal processes.
14. Rasch, interview.
15. Colonel Charles M. Howard, (USCENTCOM Chief, Strategic Deployments Division CCJ-3S), interview by the author, 11 January 2013.
16. AFDD 3-17, 23.
17. AFDD 1, 54-55, 75. Generally speaking, C-130's will be under the Operational Control (OPCON) of the Commander, Air Force Forces (COMAFFOR) with Tactical Control (TACON) to the JFACC (but the USAF usually dual-hats the COMAFFOR and JFACC). The OPCON for C-17s usually remains with Air Mobility Command (AMC) with either limited TACON given to the AMD or the aircraft remain under AMC's TACON. Commercial tenders are operated under civilian control.
18. AFDD 3-17, 42.
19. Huard, "A Theater Express Program," 2.
20. HQ USAF/A9L, *OEF Intra-theater Air Mobility,* 5.
21. Howard to the author, email.
22. Department of Defense, *Quadrennial Roles and Missions Report*, 20. "In 1986, another Army-Air Force agreement identified the Army as the executive Service for aircraft in units

organic to the land force and employed within the land component's area of operations." Thus, Army retains control of its rotary-wing aircraft and light operational support airlift and liaison aircraft. See also: JP 3-17, II-4.

23. LTC Timothy White, US Army (CJ4 RC-South, June 2011-October 2011; Brigade Combat Team Support Operations Officer, November 2005-November 2006), interview by the author, 6 December 2012.

24. Department of Defense, *Quadrennial Roles and Missions Report*, 20.

25. Ibid., 19.

26. Rasch, interview. The AMD operates on a 72-hour cycle, handling 3 days at a time. Today is in execution management; tomorrow is being scheduled and built into the Air Tasking Order; the second day out is being developed into an executable schedule. New requirements inside the 48-hour out window that can't be handled with an aircraft already scheduled require senior officer approval to drop one mission to support another.

27. HQ USAF/A9L, *OEF Intra-theater Air Mobility,* 17.

28. CONEMP: TS/MC, 6-7. As outlined in this document and many others, debates about the responsiveness of the Air Force to Army mobility needs have been a recurring theme in inter-service relations for decades.

29. White, interview.

30. HQ USAF/A9L, *OEF Intra-theater Air Mobility*, 21. The report lists 13 separate systems, but misses other systems such as Single Ticket Tracker (STT) and Logistics Module (LOGMOD).

31. Rasch, interview. The term FRAG is short for Fragmentary Order. In the context of an intratheater airlift move, it contains the primary elements needed to execute the mission: schedule, routes, stops, and cargo/passengers for each leg.

32. Rasch, interview.

33. Rasch, interview.

34. Rasch, interview.

35. White, interview. In his experience, most change requests required at least a colonel (O-6) to make the change request in order to carry enough weight to gain the attention of the waiver authority in the AMD.

36. White, interview. It is exasperating and frustrating for the customer to have to constantly elevate requests when a direct connection to the tactical planners would reduce the time/effort to communicate the request.

37. Hughes, *Direct Support of Warfighting Forces*, 26-30. In DS-A, the Air Force assets support a single unit, such as an Army Division. In GS-A, the Air Force assets will support the entire component, such as the entire surface component (USF-I).

38. CONEMP: TS/MC, 14.

39. CONEMP: TS/MC, 14.

40. Colonel Eric S. Mayheu (Commander, 777th Expeditionary Airlift Squadron, January 2010-March 2010), interview by the author, 20 November 2012.

41. Mayheu, interview.

42. Hughes, *Direct Support of Warfighting Forces*, 32, 34. Using apportioned lift vs. direct support allows the AMD to add cargo and passengers to schedule legs, and to add additional lanes after the primary user's requirements are met to increase the load factors, and thus efficiency, of the aircraft.

43. AFDD 1, 37.

44. Brown, *Divergent Paths*, 31.

45. Ibid., 33.

46. Rasch, interview. The primary source of tasked cargo and passengers was usually on the AMD's fragmentary order (FRAG) spreadsheet. AMC C2 systems such as Global Decision Support System-II (GDSS II) may or may not be updated with the latest information during execution.

47. Colonel Keith Green (AMD Chief Mobility Officer, June 2008-September 2008), interview by author, 14 November 2012.

48. Xie, "Topological Evolution of Surface Transportation Networks," 222.

49. Savelsbergh, "DRIVE: Dynamic Routing of Independent Vehicles," 476.

50. Y Guo et al., "Carrier Assignment Models in Transportation Procurement," 1472.

51. During contingency operations, the Air Force component acts as a fleet owner flying C-130s; a distributor delivering people and goods within the theater; and a retail location operating bases to receive and consume those goods.

52. Chris Kozak (Domestic Transportation Director for Walmart), interview by the author, 29 November 2012. Empty miles are recorded when a tractor drives with an empty trailer or without a trailer attached.

53. Kozak, interview. Walmart has over 4,000 domestic stores.

54. Kozak, interview.

55. Kozak, interview.

56. Kozak, interview.

57. Y Guo et al., "Carrier Assignment Models in Transportation Procurement," 1473.

58. Kozak, interview.

59. Kozak, interview.

60. Kozak, interview.

61. Y Guo et al., "Carrier Assignment Models in Transportation Procurement," 1473.

62. Levinson, "Self-Organization of Surface Transportation Networks," 402.

63 .Tunner, *Over the Hump*. 24, 65, 67, 94-95. Lt Gen William H. Tunner, is often called the Father of Air Mobility. In his memoirs, he describes several instances of using commercial management techniques to improve the effectiveness, safety, and efficiency of airlift operations.

64. JP 3-17, III-13.

65. USTRANSCOM, *TWCF Rate Procedures*, 1.

66. USTRANSCOM, *2011 Annual Report*, 18.

67. Ibid., 8.

68. Howard, interview. The CENTCOM Director of Logistics (J-4), was grieved by the large amount of airlift used for conventional sustainment that could have used surface lift or have been aggregated into larger shipments.

69. Gomez, C*entralized Command-Decentralized Execution*, 5.

70. CONEMP: TS/MC, 7-8.

71. Caudill, Packard & Tembreull, "Defending the Joint Force," 95. At the completion of their required vulnerability times, the F-16s were released to the local base commander's tactical control to meet local needs. For the fighters' case, it was armed over-watch and area defense.

72. Lt Col David Kincaid (Commander, 386th Expeditionary Airlift Squadron October 2010-February 2011), interview by the author, 3 December 2012.

73. Gomez, C*entralized Command-Decentralized Execution*, 24. The squadron is the standard tactical command structure in the Air Force, but this scheduling and dispatch function could take on other forms as well—such as aerial ports.

74. Blomme, *Decentralizing Centralized Control*, 21.

75. White, interview.

76. Rasch, interview.

77. Devereaux, *Theater Airlift Management and Control*, 71. In 1993, Lt Col Devereaux had identified the need to integrate the information flow between the strategic (intercontinental/intertheater) with the tactical (intratheater).

78. Gomez, C*entralized Command-Decentralized Execution*, 20.

79. Blomme, *Decentralizing Centralized Control*, iv.

80. Devereaux, *Theater Airlift Management and Control*, 18. "TALOs decreased the number of inefficient emergency airlift requests by matching short-notice requests with previously scheduled missions, minimizing disruption and increasing aircraft utilization rates." The TALOs enabled in-system selects for emergency requirements by having visibility on available assets at the user level.

81. White, interview.

82. Brown, *Divergent Paths*, 67.

83. Howard to the author, email. 25% of the daily capacity in Afghanistan is apportioned to DS-A missions.

84. Colonel Mark MacDonald (Deputy Chief of AMD January 2010-May 2010), interview by author, 14 November 2012.

85. White, interview.

86. Hughes, *Direct Support of Warfighting Forces*, 28.

87. HQ USAF/A9L, *OEF Intra-theater Air Mobility*, 14-15.

88. Huard, "The Theater Express Program."

89. Bowersox et al., *Supply Chain Logistics Management*, 66.

90. Ibid., 67.

91. JP 4-0, I-8.

92. Bowersox et al., *Supply Chain Logistics Management*, 80.

93. Ibid., 76.

94. Ibid.

95. Ibid., 56.

96. Leung et al. "A 0-1 LP Model for the Integration and Consolidation of Air Cargo Shipments," 403.

97. Bowersox et al., *Supply Chain Logistics Management*, 346.

98. Kozak, interview.

99. Kozak, interview.

100. Hughes, *Direct Support of Warfighting Forces*, 1. Increasing visibility and access are paramount to risk pooling in order to round out demand variability.

101. Brown, *Divergent Paths*, 35. For example, crews are often limited in the total amount of time they can fly in a given day. There is often a very small window of opportunity to make a decision. Having to gain permission and action from AMD in order to fill a user need may take too long to complete, bypassing the window of opportunity.

102. This is not to say that some carriers, such as ice truckers, will not take extreme risks because of the great payoffs.

103. Hupy, *Tactical Control of Air Mobility Forces*, 22-25.

104. Blomme, *Decentralizing Centralized Control*, 25.

105. The target load factor depends upon the industry and the route. Commercial airlines seek 85% or higher load factors, while Walmart is satisfied with an average load factor of 75% or better. (Kozak, interview).

106. Mayheu, interview. Frequency channels essentially are bus routes for aircraft. They fly a pre-set series of legs, regardless of the planned loads on each leg. Planners work to consolidate and aggregate loads to use the channels as much as possible, but this increases customer wait time. AMD accepts lower load factors in order to give users a predictable schedule.

107. Savelsbergh, "DRIVE: Dynamic Routing of Independent Vehicles," 476. DRIVE is one example of a route optimization software package.

108. Kozak, interview. Walmart has reduced their empty miles down to less than 25% of total miles driven from a baseline of 35% just 5 years ago.

109. Kozak, interview.

110. Savelsbergh, "DRIVE: Dynamic Routing of Independent Vehicles," 476. The model constraints enable the planner to change hard constraints for effectiveness while optimizing routing and scheduling for efficiency.

111. Devereaux, *Theater Airlift Management and Control*, 18.

112. USTRANSCOM, *2011 Annual Report*, 8.

113. HQ USAF/A9L, *OEF Intra-theater Air Mobility*, 1.

114. Hinote, *Centralized Control and Decentralized Execution*, 64.

115. Howard, interview.

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