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PAPER

Use of the C-27J Fixed-Wing Aircraft for Conducting Army Mission Critical, Time Sensitive Missions in Counterinsurgency Operations

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Prepared for the United States Army

RAND ARROYO CENTER

The research described in this report was sponsored by the United States Army under Contract No. W74V8H-06-C-0001.

Library of Congress Cataloging-in-Publication Data is available for this publication.

ISBN 978-0-8330-4757-1

Published 2010 by the RAND Corporation
1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665
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Preface

The Army believes that it needs the new joint cargo aircraft, the C-27J Spartan, to transport mission critical, time sensitive (MCTS) cargo and passengers to the brigade combat teams and supporting forces conducting full-spectrum operations. This issue is relevant in today's wars in Iraq and Afghanistan and in future counterinsurgencies where ground forces are widely dispersed across long resupply distances, as well as in stability operations overseas and support to civil authorities at home. Two related questions arise: Is the C-27J Spartan a reasonable replacement for the C-23 Sherpa that is being used today in Iraq to deliver MCTS cargo and passengers? Are there ways to improve the resupply routes and the air tasking procedures that are currently being used by the Army to provide direct support to the field commanders?

In April 2009, after the research phase of our study was completed, the Secretary of Defense decided to place the Air Force in charge of the C-27J Joint Cargo Aircraft (JCA) program and reduce the number of aircraft procured from 78 to 38. In speaking to reporters, Pentagon Comptroller Robert Hale explained that "what we're looking for in transferring to the Air Force is to exploit some synergy between the C-130s, particularly the C-130s the Air Force has, and the JCA." This programmatic change does not alter the findings of our study. Irrespective of whether the Air Force or the Army owns and operates the C-27J aircraft, the Army needs to have access to a responsive airlift system that can deliver MCTS cargo to the forward operating forces. This requires an air scheduling system that incorporates rapid approval procedures and does not lead to excessive aircraft holds and procedural delays.

This paper should interest those involved with 2010 Quadrennial Defense Review and with Army rotary-wing and fixed-wing airlift. The research was sponsored by the Deputy Chief of Staff, G-8; and the study progress was monitored by the Army Quadrennial Defense Review Office, Office of the Deputy Chief of Staff, G-8.

The research was conducted in RAND Arroyo Center's Force Development and Technology Program. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center sponsored by the United States Army.

The Project Unique Identification Code (PUIC) for the project that produced this document is DAPRQ08117.

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Summary

The Army believes that it needs a replacement for the C-23 Sherpa aircraft that provides, among other things, transport of MCTS cargo and passengers to brigade combat teams and supporting forces conducting combat operations. This issue is particularly relevant in counterinsurgency (COIN) operations in Iraq and Afghanistan where ground forces are widely dispersed across long resupply distances. Since the Army must be prepared for similar contingencies in the future, this requirement will be a continuing one for the Army. The Army leadership believed it found a good replacement for the Sherpa in the C-27J Spartan aircraft. This occasional paper answers two questions concerning this issue. First, is the C-27J Spartan, in fact, a reasonable C-23 Sherpa replacement for the MCTS cargo and passenger mission? Second, are there ways to improve the resupply routes and the air tasking procedures that are currently being used by the Army to provide direct MCTS support?[1]

Comparing the C27J Spartan and C23 Sherpa for the MCTS Mission

While there is no quantitative definition of MCTS, it usually refers to the delivery of supplies or personnel to a point of urgent need in a short time period, typically less than 24 hours and usually much less. Examples of MCTS cargo include such items as blood, repair parts for grounded aircraft, and ammunition. Some cargo, such as helicopter rotor blades, is somewhat large; other cargo—ammunition, for example—may be fairly heavy. As a result, an aircraft tasked for the MCTS mission should be properly sized for the cargo it will carry. MCTS missions in dispersed COIN operations also imply that the aircraft needs to possess a reasonably long range and the capability to land and take off on a short, rough field. Finally, a reasonable cost to procure and operate the aircraft is important.

In all performance categories, the C27J Spartan is superior to the C23 Sherpa. Its range is substantially greater. It has twice the cargo capacity, can carry more troops, and is able to take off in a shorter distance and from rough airfields. This enhanced performance comes at a greater procurement cost, but the operating costs appear to be similar to those of the Sherpa.

The additional performance is important. In Afghanistan, for example, the Army has been unable to use Sherpa aircraft because they lack the altitude performance needed in that

[1] In April 2009, the Chief of Staff of the Army (CSA) decided that the C-27J Joint Cargo Aircraft and all funding for it should be given to the Air Force. After the CSA informed the Secretary of Defense of this decision, Requirements Memorandum Decision (RMD) 802 was published. This memorandum goes beyond just the C-27J and affects the C-23 and to some extent the C-12 aircraft. This programmatic change does not alter the findings of our study. Irrespective of whether the Air Force or the Army owns and operates the C-27J aircraft, the Army needs to have access to a responsive reresupply system that can deliver MCTS shipments to the forward operating bases. This requires an air scheduling system that incorporates rapid approval procedures and does not lead to excessive aircraft hold and procedural delays.

mountainous country. Instead, the Army is forced to rely heavily on CH-47 helicopters and contracted fixed-wing aircraft to perform the MCTS mission there. The main issue this substitution raises for the Army is cost, although relying on contracted air support (sometimes from foreign sources) to perform critical battlefield tasks is problematic. CH-47 operating costs are high—on the order of five times that of the Spartan and Sherpa. Moreover, the extensive use of CH-47s for these missions causes substantial wear on the aircraft and reduces the number available for their primary assault role. The commanders in Afghanistan have repeatedly noted a shortage of rotary-wing lift assets to conduct operations across that very large battlespace.[2] Contracting aircraft for the MCTS role also carries substantial cost and may incur other operational limitations. Given these factors, the C27J Spartan is a reasonable replacement for the C-23 aircraft in the MCTS role. In fact, such a replacement would provide a substantial improvement in capability over the older aircraft.

Improving Air Tasking Procedures for the MCTS Mission

Unlike the normal airlift systems used by the Services to move materiel and personnel, the movement of MCTS items is handled separately in recognition of their high priority. One consequence is that neither the Army nor the Air Force possesses an air tasking system that is optimized for MCTS deliveries. A flow graph of the Army and Air Force air tasking procedures is shown in Figure S.1. The bottom half of the chart (shown in blue) summarizes the jointprocess used to plan and execute airlift within the Central Command (CENTCOM) area of operations. The joint process involves several decision points, different organizations, and multiple approvals. Further, the same process is used to move both MCTS and non-MCTS cargo and personnel. The top portion of the figure (shown in green) summarizes the Army's air tasking procedures, which utilizes both formal and informal processes to plan and execute air missions.[3] If the Army bypasses the Air Force's tasking process, its process is faster and more direct but is only available for use with Army-controlled aircraft. The joint air tasking process is based on a 72-hour planning cycle, while the Army process is based on a 24-hour planning cycle. Both processes can accommodate emergency shipments (MCTS missions), but the Air Force process requires general officer approval to change a tasking. Colonel-level approval is required to change an Army tasking.[4]

In summary, the Army's direct support approach using its organic aircraft is inherently more responsive for moving MCTS shipments. The Air Force's general support, common-user airlift approach, with its competition between users, its more complex scheduling procedures,

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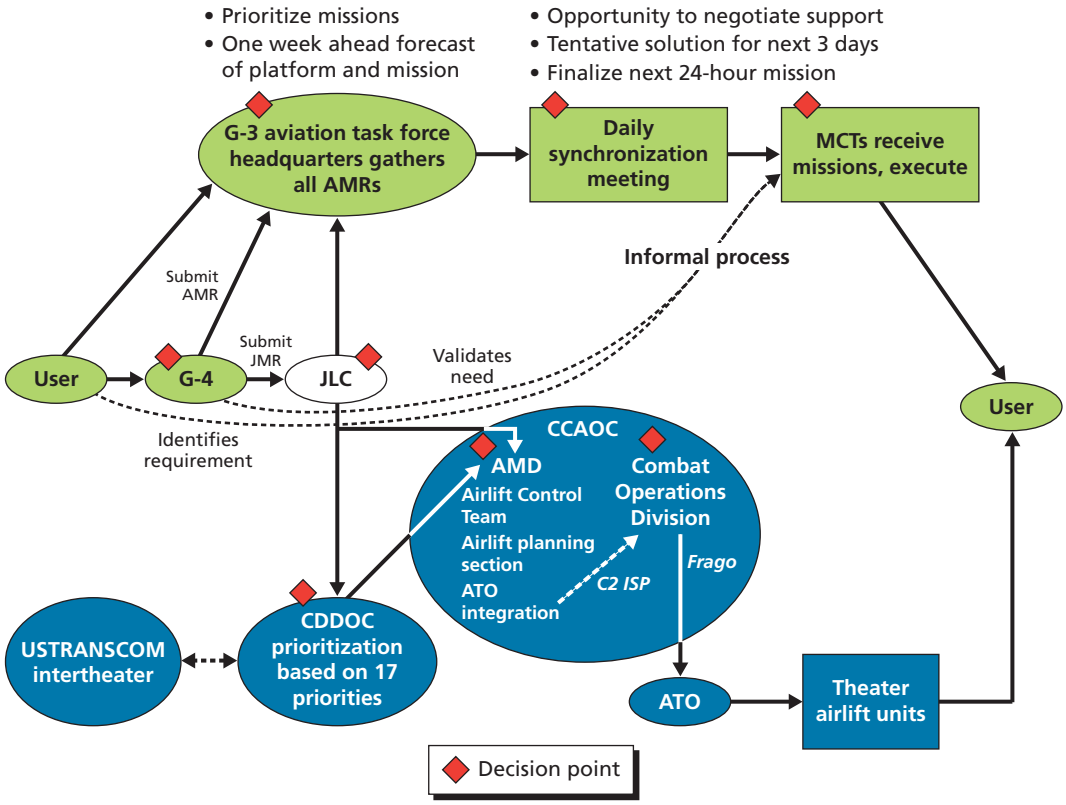
[2] Even the C27J Spartan would not be available everywhere in Afghanistan. There are simply not enough adequate landing areas throughout that underdeveloped and mountainous country. However, using a combination of rotary-wing aircraft, e.g., CH-47s, and fixed-wing aircraft with capabilities similar to the C27J in a hub-and-spoke arrangement could significantly reduce the flight hours incurred by the rotary-wing aircraft.

[3] As described by members of the 101st Airborne Division Combat Aviation Brigade after returning from a deployment to Afghanistan. Some details may be particular to Afghanistan, but we believe that this diagram is representative of the general air tasking process in any theater of operation.

[4] Figure S.1 shows a dashed arrow going from the G-4 to the movement control team box. This illustrates the routing for the informal process. It involves using "space available." In this case, the requestor deals directly with the services' air operations center, and the request is added to the manifest on the next available flight. A similar process is used by the Air Force: If a part needs to move and there is a scheduled flight, a user can request space available to move it. Of course, there is no guarantee that space will be available on the next flight.

Figure S.1
Process for Requesting Air Assets in the Theater



SOURCES: Army Rotary Wing Scheduling Process, LTC McCleary and interviews with 101st AVN Brigade; Tripp et al., 2006.

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and its efficiency criteria in scheduling cargo, requires workarounds for the rapid delivery of MCTS shipments. Both Services, however, should be able to improve the responsiveness of delivering MCTS, but the Army should be in a better position to do so if it retains direct control of its fixed-wing and rotary-wing aircraft. Some possible improvements could include the following:

- Formalize the practice of accepting last-minute MCTS in the air tasking procedures of the Army and Air Force.
- Place some aircraft, whether Air Force or Army, on strip alert for urgent MCTS deliveries.
- Reserve a certain fraction of the cargo bay of each aircraft for last-minute MCTS additions.
- Consolidate Army and Air Force management of air tasking requests and provide real-time visibility to all scheduled Army and Air Force airlift.
- Equip a theater with enough airlift aircraft to provide more direct support aircraft.
- Develop and enforce stricter rules concerning what shipments are considered high-priority MCTS.

In the longer term, each Service's logistics distribution system should be redesigned to better support COIN operations. One important element of the redesign effort should be an improvement in the process for rapidly tasking the delivery of MCTS shipments.

Acknowledgments

We are grateful to Timothy Muchmore, Army QDR Office, DCS G-8, for his guidance and interest in the study. The authors wish to thank LTC Thomas McLeary, DAMO-AV, DCS G-3/5/7, for providing technical information, arranging meetings, and assisting us in various ways. We also thank the following Army personnel for providing information on Army aviation: John Fain, TRADOC Capability Manager for Lift; LTC Thomas O'Connor, 101st Combat Aviation Brigade; MAJ Jay Schroder, CJTF101 CJ4; and Lt Col Brian Dwyer, AF/A5RM.

We benefited greatly from the insightful technical reviews provided by LTG Vincent M. Russo, U.S. Army (retired), and David Orletsky, RAND.

At RAND, we thank Bruce Held for his help in organizing the contents of the paper, Karin Suede for her dedicated work in preparing the numerous drafts and the final manuscript, and Miriam Polon for her editorial assistance.

Abbreviations

AMD	Air Mobility Division
AMR	air mission request
AOG	aircraft on ground
AOR	area of responsibility
APOD	aerial port of debarkation
APOE	aerial port of embarkation
ARNG	Army National Guard
ATO	air tasking order
BCT	brigade combat team
C2 ISP	command and control information systems planning
CAB	combat aviation brigade
CAOC	Combined Air Operations Center
CCAOC	CENTCOM Combined Air and Space Operations Center
CDDOC	CENTCOM Deployment Distribution Operations Center
CENTCOM	U.S. Central Command
COIN	counterinsurgency
CONEMP	concept of employment
COP	combat outpost
DCS	Deputy Chief of Staff
DoD	Department of Defense
FOB	forward operating base
FRAGO	fragmentary order
GO	general officer
GPS	Global Positioning System
HEMTT	heavy expanded mobility tactical truck
ISP	Internet service provider
JLC	Joint Logistics Command
JMR	joint mission request

JPADS	Joint Precision Airdrop System
MAGTF	Marine Air-Ground Task Force
MCT	movement control team
MCTS	mission critical, time sensitive
OSAA	Operational Support Airlift Agency
OSD	Office of the Secretary of Defense
SOF	special operations forces
USTRANSCOM	U.S. Transportation Command
VFR	visual flight rules

Use of the C-27J Fixed-Wing Aircraft for Conducting Army Mission Critical, Time Sensitive Missions in Counterinsurgency Operations

Introduction

Currently, the Army owns and flies C-23 Sherpa fixed-wing aircraft that are operated by the Army National Guard (ARNG). While these aircraft have served the Army well,[1] they are scheduled to be replaced by the larger and more capable joint cargo aircraft, the C-27J Spartan.[2] A total of 54 C-27J aircraft were to be procured for the U.S. Army and operated by the ARNG and the U.S. Army Reserve. Later, a decision was made to place the Air Force in charge of the program and reduce the number of aircraft procured.[3] The primary use for the C-27J Spartan, as for the Sherpa, is to resupply cargo and transport passengers to support ground operations in full-spectrum operations.[4] This paper focuses on one aspect of the resupply mission, namely, the delivery of mission critical, time sensitive (MCTS) shipments to brigade combat teams (BCTs) conducting combat operations. In this paper, we examine two issues: (1) Is the C-27J Spartan a reasonable replacement for the C-23 Sherpa that is being used today in Iraq to deliver MCTS cargo and passengers? and (2) Are there ways to improve the

[1] During its first four-month period in Iraq in 2005, the C-23 Sherpa company from Alaska ARNG's 207th Aviation Battalion logged more than 1,400 hours and transported 1,800 personnel and 1.5 million pounds of cargo (MSGT Lek Mateo, "Alaska's Sherpa Crews Tackle Desert Duties," Defend America, U.S. Department of Defense News About the War on Terrorism, August 12, 2005).

[2] The Army's Sherpa fleet is aging. Forty-four C-23B/B+ aircraft were procured in the 1980s from Short Brothers, Belfast, Northern Ireland. Even if the C-23B/B+ fleet were upgraded by standardizing global positioning systems, high-frequency radios, airdrop equipment, aeromedical evacuations equipment, and engine upgrades, they still could not adequately perform the MCTS mission of servicing high-altitude sites, such as those in Afghanistan, because of the low service ceiling and unpressurized cabin.

[3] In April 2009, the Chief of Staff of the Army (CSA) decided that the C-27J Joint Cargo Aircraft and all funding for it should be given to the Air Force. After the CSA informed the Secretary of Defense of this decision, the Office of the Secretary of Defense published Requirements Memorandum Decision (RMD) 802. As a result of this decision, the Army and Air Force have written a concept of employment (CONEMP) on how the Air Force will employ the C-27J and C-130 aircraft to support the Army's MCTS shipments. The CONEMP has recommended that an Air Force Expeditionary Airlift Squadron be collocated with an Army Combat Aviation Brigade or Aviation Task Force in order to build trust and responsiveness. This concept was tested in Iraq using C-130 aircraft. In these tests, the Ohio Air National Guard's 179th Airlift Wing was embedded with the 3rd Combat Aviation Brigade that is part of the 3rd Infantry Division. (*Joint Cargo Aircraft (JCA),* U.S. Army Aviation Center web release, dated March 22, 2010; Bruce Rolfsen, "In the Army Now: U.S. Pilots Join Army Aviation Brigade in Iraq," *Defense News,* June 21, 2010).

[4] There is also a role for the C-27J in peacetime. As the C-23s have done in the past, the C-27Js will be available to support state governors' responses to state crises and natural disasters. They will also be available to assist with homeland defense.

resupply routes and the air tasking procedures that are currently being used by the Army to provide direct support to the BCT commanders?[5]

To investigate these two issues, we make two assumptions:

- An Army requirement exists for direct support delivery of MCTS cargo and passengers to the BCTs and their support forces.
- The military will procure enough C-27J Spartans to support the MCTS missions in Afghanistan and Iraq.

The answers to four interrelated questions help us address the two main issues of this research:

- In a dispersed counterinsurgency (COIN) environment, what MCTS shipments do the BCTs need and how quickly?
- What aircraft characteristics and capabilities are needed to perform the Army's MCTS mission in a COIN environment?
- What tasking procedures are needed to provide delivery of MCTS shipments to dispersed BCTs?
- What changes in organization and employment of joint airlift assets are needed in future COIN operations?

Once these questions have been examined, we will be in a better position to comment on the use of the C-27J fixed-wing aircraft for conducting MCTS missions in COIN operations.

Mission Critical, Time Sensitive Shipments

While there is no quantitative definition of MCTS, it usually refers to the delivery of non-routine equipment, supplies, or personnel to a point of need in an accelerated time period.[6] Different MCTS prioritization categories have been used by different ground force units and by different resupply transport units. For example, in Iraq, the C-23 units have categorized blood, aircraft on ground (AOG),[7] priority equipment and parts, and ammunition as MCTS items. In Afghanistan, the CH-47 and the UH-60 helicopters that perform ring-route resupply missions include the movement of special operations forces (SOF), the removal of casualties and detainees, and the resupply of food and water to their priority list of MCTS shipments.[8] In the end, however, what constitutes an MCTS item is left to the discretion of the supported commander.

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[5] By direct support, we mean "a mission requiring a force to support another specific force and authorizing it to answer directly to the supported force's request for assistance (typically anywhere between the port of debarkation and the point of effect)" (Department of Defense, *Quadrennial Roles and Missions Review Report*, January 2009, p. 20).

[6] The *Quadrennial Roles and Missions Review Report* (p. 38) defines MCTS requirements as the "delivery of equipment, supplies and personnel that are generally non-routine in nature and must be delivered to the point of need or point of effect in an accelerated time period."

[7] AOG refers to aircraft that are unable to fly for some reason, such as lack of a repair part.

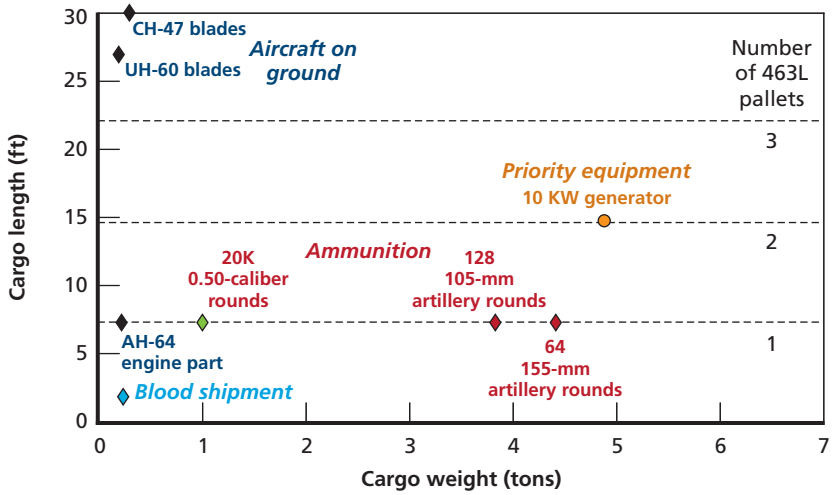
[8] *Ring routes* are resupply routes that follow a ring-like pattern, with each ring routinely servicing several remote sites. In Afghanistan, there are a dozen or more separate ring routes, each delivering cargo and personnel to three or more forward

The physical size and weight of some generally accepted MCTS cargo items are shown in Figure 1. These items can vary dramatically in size from cargo crates a few feet in length for shipping blood to containers that are 30 feet in length for shipping replacement helicopter rotor blades. The associated weight of MCTS items can range from a few hundred pounds for blood shipments to multiple tons for certain priority equipment such as electricity generators.

In terms of how quickly MCTS shipments are needed, requirements vary from a few hours for blood shipments to over a day for less-critical supplies.[9] The urgency of the delivery of an MCTS item is situation-dependent. In general, a nominal requirement for most MCTS items is less than one day.[10] The 2008 *Quadrennial Roles and Missions Review Report* concurs with the one-day response time for MCTS shipments.[11]

Another issue is how frequently MCTS missions are performed. Data exist for C-23 missions flown in Iraq, but not for resupply missions in Afghanistan. Mission reports for C-23 aircraft recorded in Iraq over three periods between 2004 and 2008 indicate that MCTS

Figure 1
Examples of Mission Critical, Time Sensitive Cargo[12]



RAND *OP254-1*

operating bases (FOBs) or combat outposts (COPs). Two helicopters are usually used to perform the resupply missions—either two CH-47s or one CH-47 and one UH-60. A typical ring-route delivery to a forward site occurs once or twice a week, over a ring-loop distance of several hundred miles.

[9] Based on data recorded in Iraq during October–December 2007, 12 percent of the MCTS blood shipments were designated as either priority (needed within six hours) or urgent (needed within two hours) (Task Force 56 MED, LSA Anaconda, Iraq, briefing, February 2008). The U.S. Army Medical Materiel Center, Southwest Asia, also reports monthly priority shipments. During 2008, it reported 4–38 critical shipments per month.

[10] A representative example of an MCTS delivery is the requirement to fly a replacement transmission for the primary forklift that downloads supplies in Baghdad. This urgent request required the C-23 to transport the transmission in less than 12 hours to reduce the impact to flight operations at the aerial ports of debarkation (APODs).

[11] "Time sensitive/mission critical movement requirements are usually conducted with less than 24 hour notice" (*Quadrennial Roles and Missions Review Report*, 2009, p. 38).

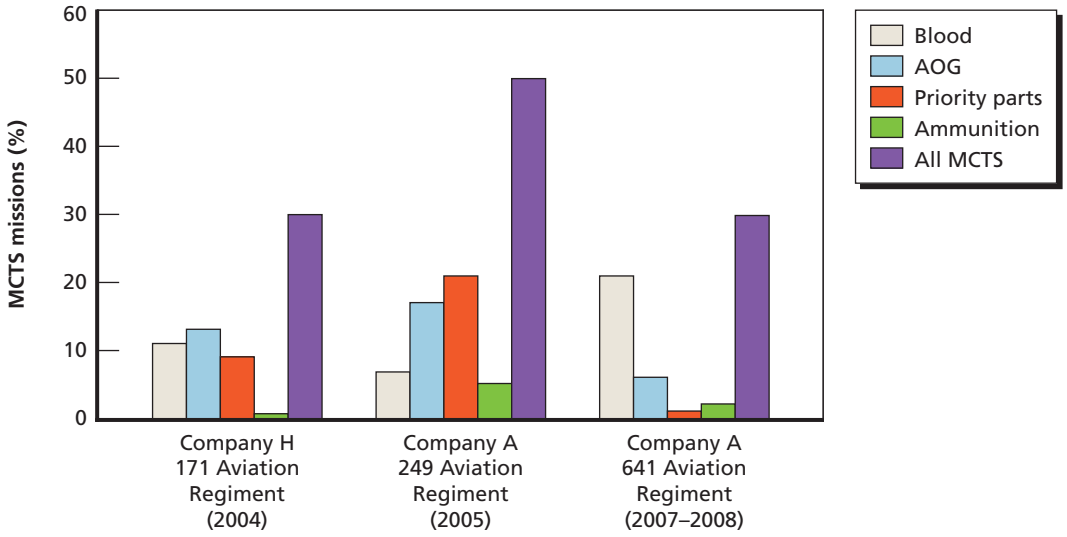
[12] Figure 1 is similar to a figure created by Dan Norton as part of a RAND intratheater airlift study.

shipments accounted for 30–50 percent of the C-23 missions flown.[13] This means that the C-23 aircraft flew approximately 50 MCTS missions per month over a 26-month period between 2004 and 2008. As shown in Figure 2, AOG, other priority equipment, and blood shipments accounted for most of the MCTS missions. Ammunition shipments, while clearly important, were generally limited to a few missions over the same time periods.

The CH-47 helicopters flying ring-route resupply missions in Afghanistan demonstrate a pattern of MCTS activities that is similar to the C-23 flights in Iraq, in that urgent MCTS items can be added at the last moment to rotary-wing aircraft that are in final preparations for takeoff. Although quantitative data on the number of MCTS flights in Afghanistan are not available, anecdotal evidence based on interviews with CH-47 personnel who have recently returned from Afghanistan indicate that MCTS shipments are frequently requested.[14] In fact, almost every daily CH-47 mission carries some MCTS cargo item or person that needs to be moved urgently and is not accommodated in the schedule generated by the routine planning cycle. The normal practice entails a flurry of emails and phone calls from units trying to gain daily posting of the air tasking order for the next day's missions.

In summary, MCTS items are specified by the supported commanders. They are designated as critical items that are needed urgently. They thus require special handling or movement priority. Their priority derives from the type of MTCS shipment and its importance to the unit's

Figure 2
Percentage of C-23 Missions in Iraq That Carried MCTS Shipments



SOURCE: C-23 Mission Reports.
RAND *OP254-2*

[13] C-23 mission reports were available for 3,185 missions flown over a 26-month period (data provided by John Fain, TCM-Lift Center, U.S. Army).

[14] Interviews conducted with personnel from 101st Airborne Division Combat Aviation Brigade (CAB) at Fort Campbell, Kentucky, on February 3, 2009.

mission, the criticality of the resource to mission accomplishment, and the urgency to deliver the MCTS items within a short time.[15] Since speed is of the essence, a streamlined air tasking process is required to accomplish MCTS deliveries—one that assigns aircraft within hours of the request, day and night.

Aircraft Performance Characteristics and Capabilities Needed to Perform the MCTS Mission

An aircraft that is capable of performing the MCTS mission should

- be properly sized for MCTS cargo/passenger missions
- provide needed speed of delivery
- experience little downtime for refueling and maintenance
- be compatible with available airfields/landing areas
- have reasonable cost to procure and operate.

Performance Characteristics

Table 1 shows key aircraft parameters for the C-27J and, for comparison, three other fixed-wing aircraft and one rotary-wing aircraft. The C-27J Spartan is the Army's replacement for the C-23 Sherpa. It has a greater range and cargo/passenger capability than the C-23. While the C-23 has proved to be extremely useful in Iraq, it cannot be used in Afghanistan because its capabilities at high altitudes are limited.[16] Because of the C-23's altitude limitation, the Spanish-built CASA C-212 Aviocar, a contractor-operated, fixed-wing aircraft, is being used in Afghanistan to deliver routine shipments between major airbases, perform airdrops, and deliver MCTS shipments as required.[17] While the C-27J cargo capacity is greater than that of the C-23 and the C-212, it is less than that of the C-130J-30 stretch body and is roughly the same as the CH-47. The CH-47F, the latest version of the workhorse CH-47 helicopter, is being transitioned in Afghanistan on the resupply ring routes. It has a shorter range than that of the fixed-wing aircraft alternatives.

Each of the aircraft shown in Table 1 is capable of performing airdrop deliveries. This is especially critical in Afghanistan, where certain FOBs and combat outposts (COPs) are

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[15] MCTS demands "cannot be routinely accommodated via planned re-supply and movement processes where efficiency is the primary consideration. Although no specific response time is specified, depending on the operational scenario and unit mission, MCTS movement requirements are usually conducted with less than 24 hours' notice (Department of Defense, 2009, p. 38).

[16] While the C-23 can theoretically fly at the high altitudes required in Afghanistan, its capabilities would be reduced as a result of mountainous terrain, weather, its unpressurized cabin, short flight range, and small payload capability. These limitations significantly reduce the C-23's value as a logistics or troop transport. When operations first began in Afghanistan, the Army's Operational Support Airlift Agency (OSAA) was asked this question. They concluded that the C-23 was not well suited for use in Afghanistan (LTC William Smith, OSAA, private communication, March 2009).

[17] According to Blackwater Worldwide, "eight Blackwater CASA C-212 light transport aircraft flew 11,000 sorties in Afghanistan last year supporting 38 combat outposts over 19,000 square miles. Its aircraft transported more than 40,000 personnel and 9.5 million pounds of supplies last year" (Michael Hoffman, "Blackwater Branches Out: Company Filling 'Gaps' With Its Expanded Air Fleet," *Air Force Times*, July 21, 2008, p. 10).

Table 1
Comparison of Aircraft Parameters

Parameter	C-130-J Stretch	C-27J	C-23	Casa C-212	CH-47F
Range (nmi)[a] (Percent of maximum payload)	2,830 (73%)	1,630 (70%)	1,030 (70%)	800 (68%)	260 (70%)
Cargo capacity (pallets)[b]	8	3	1.5 eq	1.5 eq	3
Passenger capacity (troops)[c]	94	34	30	25	33
Takeoff runway length[d] and CH-47 landing area (ft)	4,700	2,100	2,630	1,925	Approx. 200 (diameter)
Procurement costs ($M)[e]	74	38	5	Approx. 6.6[f]	29
Reimbursement rate ($/hr)	2,505 (C-130J)	2,750[g] (estimate)	1,865	n/a	10,442

SOURCES: Range: *Jane's All the World's Aircraft,* 2008-2009 edition, except for the C-23, 1992–1993 edition, and the CH-47, Boeing Company, Rotocraft Systems, 2009. Actual ranges will depend on specific aircraft configurations and flight conditions. Cargo capacity: *Jane's All the World's Aircraft*; Harding, *U.S. Army Aircraft Since 1947,* 1997; Boeing Company, 2009; Global Military Aircraft Systems, "C-27J Spartan," 2006. Passenger capacity: *Jane's All the World's Aircraft*; "C-27J Spartan," 2006; Boeing Company, 2009. Takeoff length: *Jane's All the World's Aircraft.* Procurement Costs: C-130J-30: based on SAR data; C-27J: based on U.S. Army C-27J P-40 Budget Item Justification; C-23 and CH-47F: based on President's budget and aircraft quantity; C-212: based on available data (Fred Timson, RAND, private communication). Reimbursement rate: Office of the Secretary of Defense (Comptroller), *FY 2009 Reimbursement Rates,* 2008.

[a] Range at sea level for aircraft carrying approximately 70 percent of maximum payload.

[b] Assumes 4,000 lbs per 463-lb pallet or the equivalent (eq).

[c] For the C-130J stretch and C-27J aircraft, assumes 400 lb per combat-ready soldier and one or more pallet positions reserved for baggage; for the other aircraft, assumes 250 lb per passenger.

[d] Takeoff runway length to clear 50 ft with maximum load.

[e] Procurement cost in FY 2008 dollars, except for the C-212, where the year of procurement is not available.

[f] The C-212 cost estimate is inconsistent with U.S. procurement practices (e.g., it includes manufacturing in Brazil).

[g] Assumes operating cost of a two-engine C-27J is 70 percent of the C-130J's.

typically not colocated with fixed-wing airfields.[18] The C-130J-30 and C-27J aircraft are also capable of performing airdrops using the new Joint Precision Airdrop System (JPADS).[19]

We conclude that, in terms of aircraft performance characteristics and capabilities, the C-27J is a reasonable replacement for the C-23 to deliver MCTS cargo and passengers in Iraq. However, several operational factors also influence the selection of an MCTS-capable aircraft. These factors include aircraft utilization and operational limitations due to landing sites, weather conditions, transit distances, and—in hostile environments—survivability.

[18] MAJ Jay Schroder, CJTF 101 CJ4, notes that "at least 28 locations across the country are currently reachable only by air" (that is, by aerial delivery or helicopters and not by fixed-wing aircraft or ground transportation) (Michelle Tan, "U.S. Army Tests Airdrop Parachute," *Defense News*, December 1, 2008, p. 30).

[19] The early version of the JPADS Global Positioning System (GPS) guidance system was ineffective in the mountainous terrain of Afghanistan. Improved capability has been achieved with an upgraded JPADS design that relies on redundant GPS guidance (Firefly 2K). Success has also been achieved with low-altitude air delivery systems, including the low-cost aerial delivery and low-altitude parachute systems, as well as free drops. Fixed-wing aircraft are usually used for airdrops. Currently, the Army contracts with commercial fixed-wing support to meet its airdrop requirements (Tan, 2008, p. 30).

Operational Environment

As noted earlier, the C-23 is unable to operate in Afghanistan, so CH-47 and UH-60 helicopters are providing the majority of Army airlift resupply missions in that theater. Ring routes are used to service FOBs and COPs. Because of the long flight distances between the main operating bases and the FOBs and COPs, the helicopters must occasionally fly to forward arming and refueling points to refuel, thereby adding to the substantial wear and tear they are experiencing.[20] This overuse affects aircraft maintainability and flight availability.[21] Also, as a result of being employed for logistical support, the CH-47s are not able to participate in other missions, such as the air assault of dismounted combat forces.

One advantage to using helicopters, however, is that they do not need a runway to land and take off. Fixed-wing aircraft require runway surfaces that are adequately prepared (graded earth or firmer) and sufficiently long. While the number of existing airfields in Afghanistan with the necessary runway length and surface conditions is limited, some studies have been conducted indicating that other landing sites exist within a few miles of each FOB.[22] However, many of the proposed fixed-wing aircraft landing sites are of marginal structural quality—they consist of unpaved roads, dry streambeds, or open areas. The softness of their surfaces restricts the number of takeoffs and landings they can handle before resurfacing of the airstrip is needed. Therefore, their operational utility may be limited without structural upgrades.

With regard to weather, rotary-wing aircraft are required to remain under visual flight rules (VFR) throughout their flights, thereby limiting completion of some routes, especially through mountain passes. Fixed-wing aircraft may take off and fly routes under instrument flight rules. On landing, however, fixed-wing aircraft may make instrument letdowns and approaches but require VFR conditions for landing unless the airfield is equipped with instrument landing systems. This action would require more ground support than for helicopters.

Rotary-wing and fixed-wing aircraft each possess unique survivability features. Rotary-wing aircraft are more capable of nap-of-the earth flying and have greater flexibility in selecting alternative landing corridors and directions when servicing FOBs than do fixed-wing aircraft. However, fixed-wing aircraft have the advantage of being able to fly at altitudes beyond the range of most guns and all but the most advanced air defense system missiles.[23] They are highly maneuverable, with redundant systems and communications, and have the option of installing missile-jamming capabilities for lower-altitude operations.[24] In the future, the C-27J may be

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[20] "The upcoming buildup of U.S. forces in Afghanistan will put additional pressure on the Army's already overstretched helicopter fleet. For the service's aviation units, the challenge will be twofold: keep up with a growing demand for helicopters in two major war zones and, simultaneously, maintain and upgrade a fleet that for six years has taken a beating from harsh weather and sand" (Matthew Rusling, "Overstretched: Army Helicopters Brace for Afghanistan Buildup," *National Defense*, April 2009, pp. 28–30).

[21] In Afghanistan, a CH-47 company typically logs 800 flight hours per month. This is about twice the current garrison usage. (In the past, during peacetime, the garrison usage was approximately 200 hours per month per company.) To keep the fleet going, the Army has established a "reset" program to return battle-worn aircraft to disassembly conditions. The reset cost per aircraft is $1.5 million for the CH-47s (Rusling, 2009, p. 28).

[22] Contractor analyses, private communication, 2008.

[23] Currently, the threat to aircraft in Afghanistan is limited to small arms and rocket-propelled grenades. In the future, surface-to-air threats may be present, thereby changing the dynamics of the survivability of both rotary-wing and fixed-wing aircraft.

[24] The Large Aircraft Infrared Countermeasures System counters shoulder-fired and vehicle-launched missiles by emitting a signal to confuse the path of the missile and directing it away from the aircraft ("Agreement to Keep Aircraft Defense

able to fly in threat areas denied to the C-23 because of better communications and an ability to provide threat warnings and to retask the aircraft.[25]

A hub-and-spoke configuration would permit helicopters and C-27J aircraft to collectively exploit their individual operational strengths. Significant cost savings could be achieved by using fixed-wing aircraft to make deliveries between the main operating base hubs. Rotary-wing aircraft could then be used to make shorter hops to certain FOBs and remote COPs. And fixed-wing aircraft could employ JPADS to deliver emergency supplies to FOBs and COPs when the ground situation so requires.

We have examined a hub-and-spoke configuration that would use a combination of fixed-wing and rotary-wing aircraft. In this configuration, the all-helicopter ring routes in Afghanistan would be redesigned to use fixed-wing aircraft at airfields at Bagram, Kandahar, Jalalabad, and Salerno as major distribution centers. All of the FOBs would be serviced the same number of times each week as in an all-helicopter case. We estimate that this restructuring would reduce the operational costs of the current all-helicopter case by 35 percent if fixed-wing aircraft were used on the long-haul legs. The redesign would also reduce the load on the rotary-wing assets (i.e., the CH-47 flight hours would be cut almost in half).

A combination of airdrops when possible and rotary-wing aircraft when necessary should be cheaper than the current ring-route delivery model and should provide more flexibility than either option alone. For a single delivery of an MCTS request, an airdrop from a fixed-wing aircraft appears more economical than a CH-47 air-land delivery when the round-trip distance exceeds 50 nautical miles, depending on the airdrop size.

As mentioned above, an advantage of the hub-and-spoke configuration is that fewer helicopters are required for logistics operations. The helicopters that are freed up can then be used in combat assault missions.[26]

Future operations may include resupply distances that are even greater than those experienced in Afghanistan, especially if the BCTs are widely dispersed, as would often be the case in counterinsurgencies. For example, within the African continent, intratheater transit distances can be very long (1,000 to 1,800 nautical miles).[27] Scenarios developed for a RAND study on the Air Force airlift fleet were used in this analysis.[28] This analysis is different from the airlift fleet study in that the MCTS shipments are assumed to be lighter than the cargo loads considered in the airlift study.[29] It turns out that the transit distances within the African conti-

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System at Robbins," *Military Aviation News*, December 30, 2008).

[25] LTC William Smith, S3, Fixed-Wing Battalion, ARNG, private communication (September 11, 2008).

[26] The anticipated surge of approximately 30,000 troops in Afghanistan will stress the helicopter logistics operations even more. The use of a hub-and-spoke operation should help alleviate the problem, and additional support might be provided by NATO airlift.

[27] To compare fixed-wing aircraft with helicopters and trucks, we have limited our discussion of intratheater transit to transport within the continent of Africa. Given the definition of the theater, intratheater transit could also originate in Europe (e.g., Ramstein Air Force Base or Rota Naval Station). However, in these cases, it would not be fair to compare fixed-wing aircraft with Army helicopters and trucks that are designed for land operation.

[28] In the airlift fleet analysis study, five missions (humanitarian assistance, non-combatant evacuation, counterterrorism/counterinsurgency, joint peacekeeping, crisis response/contingency operation) were considered for two delivery distances. Besides considering two cargo load sizes (light and heavy), excursions were also performed on refueling at the delivery base versus no refueling and 12-hour versus 24-hour operations.

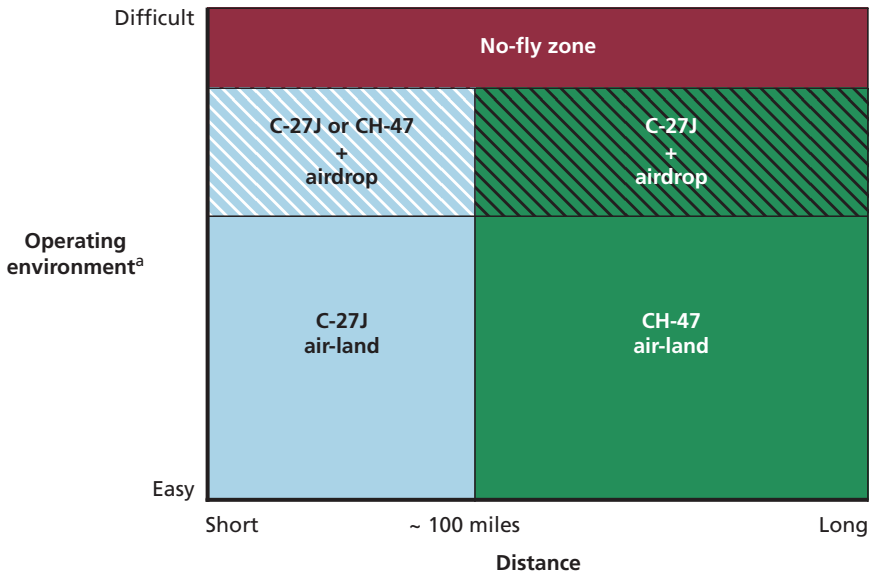
[29] The daily light cargo loads that were considered in the airlift study are heavier than the typical MCTS shipments. The lightest of the light cargo loads was 12 tons per day, while most of the light loads were 30 tons per day or heavier.

nent are so long that both CH-47F helicopters and heavy expanded mobility tactical trucks (HEMTTs) require many stops to refuel.[30] Fixed-wing aircraft, on the other hand, have the potential to service points of need without having to refuel at their destination points. In four of the seven in-country scenarios considered, the C-27Js did not have to refuel at their destination points. With their longer range, the C-130J-30s never had to land to refuel in any of the scenarios that were considered.

The cost of procuring and operating the MCTS-capable aircraft must also be considered. Unit procurement costs were shown in Table 1. While the unit costs of the C-27J and the CH-47 are comparable, that of the C-130J-30 is considerably greater. Also, the operating cost, as reflected by the OSD Comptroller's reimbursable rates for other DoD components, is very large for the CH-47F. In fact, it is more than four times greater than that of the C-130J, and we assume the same ratio is applicable to the C-27J. In terms of cost per ton-mile, a measure of cargo efficiency, the CH-47 is ten times more expensive than the C-27J.[31]

In summary, we find that the trade-off between fixed-wing and rotary-wing aircraft depends on several factors. Two of the drivers are flight distance and operating environment (threat, terrain, flight conditions, landing sites). The domains in which fixed-wing and rotary-wing aircraft are preferred are shown schematically in Figure 3. As the threat increases or the terrain or weather becomes difficult for landing, airdrop is the preferred cargo delivery system.

Figure 3
Where Fixed-Wing and Rotary-Wing Aircraft Are Most Appropriate



[a]Includes threat, terrain, flight conditions, landing sites.

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[30] Even if refueling were not an issue for the HEMTTs, the road infrastructure in Africa is so poor that, in certain cases, the roads cannot support heavy truck traffic.

[31] Cost per ton-mile is a function of operating cost per hour, aircraft speed, and cargo capacity. In terms of dollars per ton-mile, the values for the CH-47, C-23, C-27J, and C-130J are approximately 10, 7, 1, and 0.5, respectively.

As the distance increases, fixed-wing aircraft are preferred for the reasons that have already been discussed and because the need to refuel is not an issue. This transition distance from using helicopters to fixed-wing aircraft is only a hundred miles or less for the CH-47 helicopter.

While fixed-wing aircraft appear well-suited for longer-range MCTS missions, landing sites at some locations, especially those with rugged terrain and at higher elevations, will require extra preparation, including the following:

- force protection measures during aircraft operations in hostile situations
- periodic inspections and repair of runway surfaces
- availability of refueling facilities.

Even with the preparations cited above, other considerations must be taken into account. For example,

- Soft landing strips may not allow routine continuous takeoffs and landings, especially for heavy payloads.
- Safety precautions may have to be relaxed (e.g., the need to follow critical field length guidelines must be waived).[32]
- Aircraft may be susceptible to direct and indirect fire attacks, resulting in delayed or aborted landings.
- Additional tactics, techniques, and procedures may be necessary to expedite aircraft landing, transfer of personnel and materiel from fixed-wing to rotary-wing aircraft, and departure of aircraft to limit their exposure to ground fires.
- Aircraft may experience accelerated wear and tear resulting from poor-quality landing surfaces.
- Materiel handling equipment may be unavailable.

In sum, we find that the C-27J is a reasonable replacement for the C-23 conducting MCTS missions in Iraq. The aircraft has the needed range, speed, and cargo capacity. The C-27J is also capable of replacing some of the CH-47s that are currently providing resupply in Afghanistan. If the all-helicopter ring routes in Afghanistan are modified so that C-27Js are used on the long-haul legs instead of CH-47s, then this restructuring should reduce both the operational costs and the excessive wear and tear placed on the helicopters. This means that more CH-47s would be available to conduct air assault and other combat missions.

Air Tasking Procedures for MCTS Missions

The Army and the Air Force view themselves as playing important, but different, roles in supporting COIN operations. The Air Force "pushes" a large amount of materiel and passengers to main distribution points; the Army "pulls" a smaller amount of materiel and personnel to their final destinations (the last tactical mile) under more time-critical conditions. The Army has considerable logistics movement capabilities. However, the bulk of its assets are focused on

[32] All things being equal, one would want to procure an aircraft that requires fewer safety waivers under operational conditions, thereby reducing the risk to the crew. This analysis should be performed as part of the trade space in force planning.

surface movement, with investment in trucks and personnel for executing surface convoys.[33] The CH-47 is the only asset the Army owns that is capable of moving a significant amount of materiel and personnel by air. However, the CH-47s are not dedicated to logistics transport and are not tasked directly by the theater logistics command (G-4).[34]

Unlike the normal airlift systems used by the Services to move materiel and personnel, MCTS items are handled separately in recognition of their high priority. As a result, neither the Army nor the Air Force possesses an air tasking system that is optimized for MCTS deliveries. The Air Force airlift system has two principal employment concepts: hub and spoke and direct delivery. Hub-and-spoke operations integrate intertheater and intratheater airlift operations by moving a large amount of cargo and personnel from aerial ports of embarkation (APOEs), usually outside of the theater area of responsibility (AOR), to aerial ports of debarkation (APODs) within the AOR. For our Afghanistan example, airlift flows from APOEs in the Persian Gulf area to Afghanistan APODs at Bagram, Kandahar, and Salerno. Cargo and personnel are then moved within the theater to the FOBs and COPs.

The Air Force's direct delivery missions are normally limited to intertheater missions that originate at APOEs but bypass hubs and fly directly to FOBs within the theater. This process avoids the inefficiencies of transshipment at hubs, shortens delivery times, removes some load on the hubs, increases overall effectiveness, and optimizes air mobility operations to gain the greatest efficiency in use of assets. This airlift capability is especially advantageous when combat forces move into new locations or when combat forces are in high-tempo engagements requiring rapid resupply of materiel.[35]

The Army, on the other hand, manages its own air tasking process for reasons previously explained. The Army's process is faster and more direct. Every effort is made to gain efficiencies based on consolidating cargo to a location, mixing aircraft (CH-47s, UH-60s, and Sherpas) based on load, and coordinating with the combat aviation brigade (CAB) for other flights that may be in the area and able to support the mission.[36] While missions are usually projected in one-week increments, they are planned in 24-hour cycles. Once a mission is in the execution phase, the supported commanders may request space available for cargo and personnel. For routine and nonemergency requests, it is up to the crew to determine what cargo gets moved. The entire process can be trumped, however, for emergency MCTS needs. If the supported commander determines that the priority is high enough, then the MCTS mission goes forward. An Army colonel or above can bump a lower-priority item from a flight and insert a MCTS shipment.

Figure 4 is a flow graph of the Army and Air Force air tasking processes. The bottom half of the chart (shown in blue) summarizes the Air Force process used to plan and execute airlift

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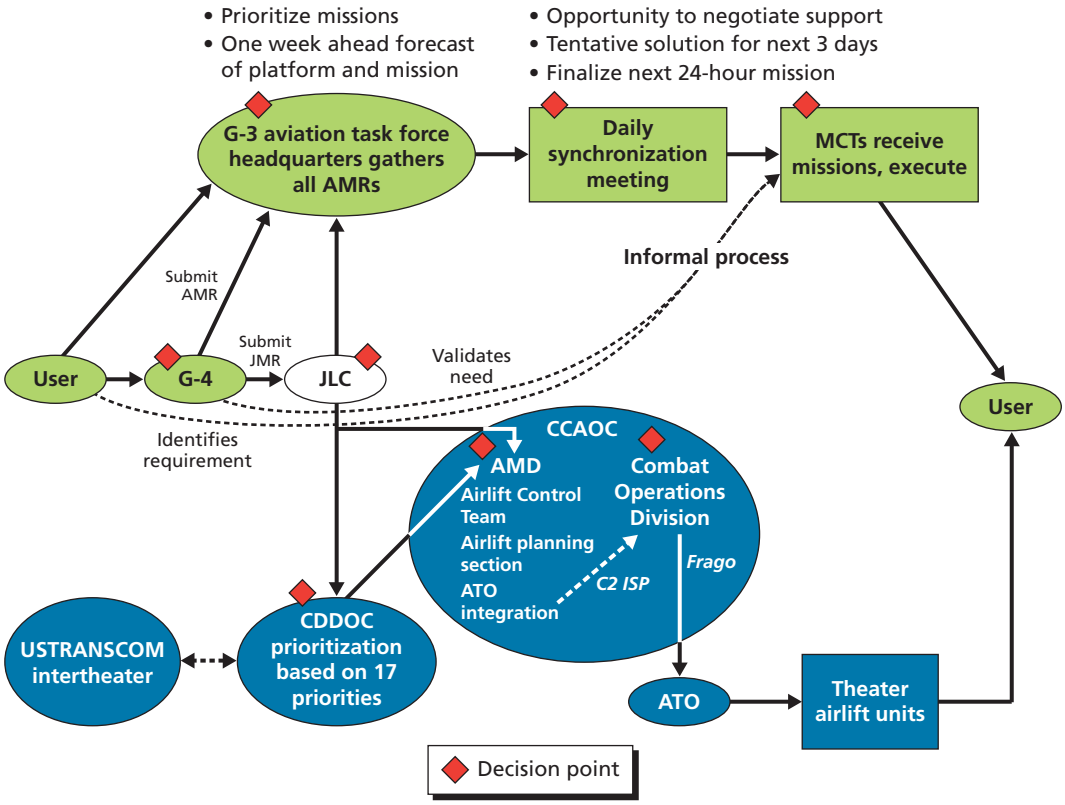
[33] According to counterinsurgency doctrine, the preferred mode of transport is by air, not by ground (Headquarters, Department of the Army, *Tactics in Counterinsurgency,* Field Manual Interim, FM 3-24.2, March 2009). While a substantial portion of items (fuel, water, large ammunition resupplies, etc.) will necessarily continue to be moved by surface, the desire to reduce exposure to roadside improvised explosive devices while still moving materiel and personnel within the area of operations has increased the need for delivery by air. This requirement for materiel movement has created a gap in the Army's logistics capabilities that is currently filled through the heavy use of CH-47 helicopters.

[34] The CH-47 is a multimission, heavy-lift transport helicopter. Its primary mission is to move troops, artillery, ammunition, fuel, water, barrier materiel, supplies, and equipment on the battlefield. Its secondary missions include medical evacuation, disaster relief, and search and rescue (Boeing Company, 2009).

[35] Department of the Air Force, *Air Mobility Operations,* Air Force Doctrine Document 2-6, March 1, 2006, pp. 42–43.

[36] LTC Thomas P. McLeary, DCS G-3/5/7, Headquarters, Department of the Army, private communication.

Figure 4
Process for Requesting Air Assets in the Theater



SOURCES: Army Rotary Wing Scheduling Process, LTC McCleary and interviews with 101st AVN Brigade; Tripp et al., 2006.

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within the Central Command (CENTCOM) AOR. Notice that the process involves several decision points, different organizations, and multiple approvals. Further, the same process is used to move both MCTS and non-MCTS cargo and personnel.

The top portion of the figure (shown in green) summarizes the Army's air tasking process as described by members of the 101st Airborne Division CAB after returning from a deployment to Afghanistan.[37] The current method for requesting resupply relies on both formal and informal processes to plan and execute air missions.

The formal process begins when a user identifies a need for an MCTS item and communicates the requirement through the logistics chain of command to the battalion S-4, where the request is validated and prioritized. The S-4 can request movement by submitting either an air mission request (AMR) for Army airlift or a joint mission request (JMR) to the Joint Logistics Command (JLC) for general support airlift or airdrop. This decision will depend on several factors, including the size and weight of the item, its location in relation to the end user

[37] Some details may be particular to Afghanistan, specifically the Joint Logistics Command (JLC), which is responsible for coordinating logistics support to all coalition forces. Nevertheless, we believe that this diagram is representative of the general air tasking process in any theater of operation.

(whether it is available locally or in theater, or must be sent from the continental United States, etc.), and the urgency of the request.

For example, suppose the S-4 determines the requirement can be filled locally (within the country) and is within the range and payload capability of a CH-47. Then the logistics officer may submit an AMR. Alternatively, suppose the item is available locally but is not within the range or payload of a CH-47. Then the logistics officer would submit a JMR requesting airlift to the closest airfield and land transportation to the final destination or airdrop to the final destination. If the materiel is within the payload capability but not the flight range, then the logistics officer could request a JMR to move the materiel to a closer location and then submit an AMR to move the materiel to the final user. If the payload and range are within the capabilities of the CH-47 but the logistics officer is not sure which means of transport will be available first, he or she can submit both an AMR and a JMR; this option is especially attractive if the final user is at a location with a landing strip capable of handling C-130s. Since the JMR and AMR processes are independent of one another, there is no way to know if the materiel is scheduled to move by multiple methods. Therefore, it is not unusual for an aircrew to wait for an item or a person who has already moved via an alternative method.[38]

After an AMR has been filled out, it goes to the G-3 Aviation Task Force Headquarters, where all Army AMRs are gathered and ordered by priority. The MCTS and lower-priority AMRs are used to build a one-week forecast of the platforms required and the number of missions needed to fulfill the needs. Each day, a synchronization meeting is held to plan the missions to be executed within the next 24 hours. Representatives from aviation units and the user communities use this opportunity to communicate the urgency of their demand and negotiate for inclusion in next day's missions. If possible, mission planners take advantage of existing rotary-wing ring routes. However, if the timing of the ring route does not meet the MCTS requirement, a direct support mission is planned. The approved missions are communicated to the Movement Control Teams (MCTs). Each aviation unit has an MCT responsible for executing the approved missions.

If the user or S-4 fills out a JMR, then the request will go to the JLC, where a priority is assigned. The JLC will try to accommodate the request either on a helicopter ring route or an Air Force star route. If the materiel is available within theater—for example, in the Defense Logistics Agency warehouse in Kuwait or in Bagram—but needs to be moved to Kandahar by C-130, the JLC forwards the JMR to the CENTCOM Deployment Distribution Operations Center (CDDOC) in Kuwait.

The CDDOC manages the assignment of materiel to all common-user aircraft in CENTCOM, validates the requirement to move the item(s) by air, and prioritizes the JMR on a 1–17 point scale (see Table 2). Once CDDOC priorities are established, the request is sent to the Air Mobility Division (AMD) at the Combined Air Operations Center (CAOC). The AMD schedules the flights for the next 72-hour planning period based on the assigned priorities. That is, a request to move materiel (which includes MCTS shipments) will not be executed earlier than 72 hours unless there is General Officer (GO) intercession. The AMD prepares and assigns requirements to specific flying organizations and assigns call signs. The proposed

[38] Interviews conducted with personnel from the 101st Airborne Division CAB at Fort Campbell, Kentucky, on February 3, 2009.

Table 2
CENTCOM Intratheater Airlift Priorities

Airlift Priority	Airlift Cargo or Passenger
1a 1b	Congressional delegations, Presidential directions, Department of State or Defense missions, as directed by CENTCOM
2	Combat and combat support operational requirements, aeromedical evacuations; emergency immediate medical shipments
3	Coalition human remains
4	Emergency ammunition; emergency medical supplies; combat sustainment; medical attendants returning to the CENTCOM AOR
5	Mail; Joint Operational Planning and Execution; various personnel movements
6	CENTCOM intratheater letters of intent; designated distinguished visitors and entertainment tours
7	Routine enemy prisoners of war, detainees, and escorts
8	Couriers (classified/financial); military intelligence working dogs
9	Fresh fruits and vegetables
10	Unit moves; all other sustainment cargo, including backlog
11	07 and 06 and civilian equivalent space booking
12	Individual passengers and U.S. embassy and operations support center trainers
13	Humanitarian assistance and combat munitions order
14	CENTCOM-sponsored exercises
15	Commercial contract support (vehicle drivers, communication technology)
16	Public affairs office and media "personalities"
17	Non-CENTCOM–sponsored exercises

air tasking orders (ATOs) are then forwarded to the Combat Plans Division for validation and become a final published ATO.[39] The planning schedule is frozen 24 hours before execution time, and changes to the plan at this point require the approval of a GO. The plan is communicated to assigned airlift units for execution.

At this level, the user is competing with all CENTCOM-generated intratheater distribution requests. Moreover, if the volume of the load going to the user's location is small, the shipment may be delayed until enough cargo is available.[40]

If the materiel is not available within theater, then a requisition is processed and airlift into theater is managed by U.S. Transportation Command (TRANSCOM). Once a shipment enters the CENTCOM AOR, its priority is reevaluated and the theater distribution process begins anew. In this case, however, the G-4 organization managing the materiel is responsible for tracking its arrival and coordinating movement forward. With each decision point, time and complexity are added to the theater distribution system.

[39] This material is excerpted from Robert S. Tripp, Kristin F. Lynch, Charles Robert Roll, Jr., John G. Drew, and Patrick Mills, *A Framework for Enhancing Airlift Planning and Execution Capabilities Within the Joint Expeditionary Movement System*, Santa Monica, Calif.: RAND Corporation, MG-377-AF, 2006.

[40] The Air Force prefers not to fly a mission unless the aircraft is carrying at least 75 percent of its capacity. This metric is used both on the trip out and the trip back, despite the fact that the volume of retrograde materiel is generally much smaller than that of the materiel moving forward.

Figure 4 shows a dashed arrow going from the G-4 to the movement control team box. This illustrates the routing for the informal process. This involves using "space available." In this case, the requestor deals directly with the Service's air operations center, and the request is added to the manifest on the next available flight. A similar process is used by the Air Force: If a part needs to move and there is a scheduled flight, a user can request space to move it. Of course, there is no guarantee that space will be available on the next flight. Another informal scheduling approach is to physically drive the MCTS cargo or passengers directly to the departure airfield and ask if room is available for the MCTS shipment to be added on the next aircraft. Once again, no guarantee can be made that space will be available.

A difference in airlift philosophy exists between the two Services, based on their operational requirements. This difference affects the delivery of MCTS shipments. The Air Force's airlift scheduling process is designed to maximize efficiency. As a result, airlift missions may be delayed until the aircraft are sufficiently loaded. Consistent with this approach, the Air Force generally makes all intratheater aircraft available for common-user, general support. This desire to maximize efficiency leads to a longer planning cycle. As noted earlier, the Air Force's planning cycle for each day's airlift schedule requires 72 hours advance notice on the part of the user, and shipment requests are not confirmed until 24 hours prior to takeoff.[41]

The Army's direct support approach is consistent with its distribution philosophy of responsiveness and support to deployed forces. The Army's scheduling process is centered on delivering essential supplies as rapidly as possible, irrespective of the status of the aircraft load. The success of the operations being conducted by the supported ground commander is the key determinant of what gets shipped and when aircraft fly. Even though the Army's focus is more streamlined than that of the Air Force, it still normally requires 24 hours to confirm a request for routine delivery of cargo or passengers. If the request is approved, the materiel or passengers are either airlifted on a scheduled flight or a mission is tailored to meet the request.

In summary, with regard to delivering MCTS shipments, the Army's direct support approach, using its organic aircraft, is inherently more responsive for moving MCTS shipments. The Air Force's general support, common-user airlift approach, with its competition between users, more complex scheduling procedures, and efficiency criteria for scheduling cargo, requires workarounds for the rapid delivery of MCTS shipments.

Both Services, however, should be able to improve the responsiveness of delivering MCTS. In the next section, we explore possible options for accelerating the delivery of MCTS items.

Changes in Organization and Employment That May Improve MCTS Shipments

In the near term, both Services could modify their scheduling processes to improve MCTS deliveries. The Army may be in a better position to do this because of its direct control of its

[41] There are typically five sets of products normally covering a 24-hour period: one undergoing assessment (yesterday's plan); one in execution (today's plan); one in production (tomorrow's plan); one in final planning; and one in development (three days out) (Department of the Air Force, *Operations and Organization,* Air Force Doctrine Document 2, April 3, 2007, p. 108).

fixed-wing and rotary-wing aircraft and its better understanding of the urgency of specific MCTS shipments.[42]

Candidate near-term changes to intratheater airlift operations for delivering MCTS shipments include the following:[43]

- Making the informal scheduling process part of the formal process (e.g., formalizing the practice of accepting last-minute MCTS in the air tasking procedures of the Army and Air Force)
- Placing some aircraft, whether Air Force or Army, on strip alert for urgent MCTS deliveries in the same way that dedicated UH-60 helicopters are provided for the ground force commander[44]
- Reserving a certain fraction of the cargo bay of each aircraft for last-minute MCTS additions. Although the Army focuses on effectiveness, efficiency can be gained by flying full (space available)
- Consolidating Army and Air Force management of AMRs with common visibility to all scheduled airlift by Army and Air Force commanders and staffs, and instituting a requirement that approved MCTS cargo and passengers go on the next scheduled aircraft when requested prior to scheduled takeoff within the limits of the aircraft
- Equipping a theater with enough airlift aircraft, including the Army's fixed-wing aircraft, to allow all aircraft to be considered for common-user as well as direct support airlift while retaining the ability to sufficiently fulfill the MCTS servicing mission in surge operations
- As discussed earlier in the paper, changing the all-helicopter ring routes by using fixed-wing rather than rotary-wing aircraft to connect key distribution centers
- Enforcing strict rules or accountability over what shipments are considered high-priority MCTS while maintaining flexibility for the commander to determine what he or she needs for success in combat operations.

In the long term, each Service's logistics distribution system should be redesigned to better support COIN operations. Some ideas for improving the effectiveness and efficiency of intra-theater airlift operations have already been studied and should be considered in the rede-

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[42] While the new CONEMP recommends that an Air Force Expeditionary Airlift Squadron be collocated with an Army Combat Aviation Brigade or Aviation Task Force, for now, CENTCOM has selected to implement an apportionment plan with a certain percentage of C-130 sorties set aside to provide direct support to the Army for the delivery of MCTS shipments. The Army's AMRs are routed through the CENTCOM Deployment Distribution Operations Center/CENTCOM Combined Air and Space Operations Center. (Lt Col Brian Dwyer, AF/A5RM, private communication, 6 July 2010). This means that the process issues discussed earlier in this paper may still be unresolved. While we understand that AMRs move more quickly in practice now, the numerous decision points involved in the tasking process remain potential bottlenecks.

[43] Some proposed changes that are presented in this paper have been implemented in the CONEMP such as apportioning a percentage of the airlift sorties specifically to the MCTS mission.

[44] Strip alert requires at least one aircraft and aircrew to be prepared to take off within a specific time. The shorter the time, the more demanding the task becomes on maintenance and aircrews. Aircraft can be scheduled to stay on alert only for a certain period of time and, unless launched during that time, put away for the next day or launched on the next scheduled non-alert mission within crew rest time limits. A second procedure is the dynamic tasking of mission diverts. The status of all capable aircraft is assessed and the one that is capable of airlifting the MCTS shipment is selected. The aircraft is diverted to fulfill the MCTS mission.

sign.[45] One important element of any redesign should be an improvement in the process for rapidly tasking the delivery of MCTS shipments.

Use of the C-27J for MCTS Missions in Counterinsurgency Operations

In summary, we provide short answers to the four questions that we raised at the beginning of this paper:

- In a dispersed COIN environment, what MCTS shipments do BCTs need, and how quickly do they need them?
  - A few critical items within less than a day.
- What aircraft characteristics and capabilities are needed to perform the Army's MCTS mission?
  - Fixed-wing aircraft if delivery distances are sufficiently long for hub-and-spoke operation and aircraft have adequate range, speed, and cargo capability.
- What tasking procedures are needed to provide delivery of MCTS shipments to supported forces?
  - Direct support.
- What changes in organization and employment of joint force assets are needed in future COIN operations?
  - Near-term procedural and far-term doctrinal changes.

Collectively, these answers allow us to comment on the two issues we raised at the beginning of this paper: (1) Is the C-27J a reasonable replacement for the C-23 for performing MCTS missions? and (2) Are there ways to improve the resupply routes and air tasking procedures being used by the Army to provide direct support to the supported commanders?

Regarding the first issue, we believe, based on our study findings, that the C-27J Spartan aircraft is a good replacement for the C-23 Sherpa.[46] The C-27J can play an important role in future COIN operations through its ability to deliver MCTS shipments in a responsive manner over long transit distances to the numerous dispersed Army sites that must be serviced. At the same time, some rotary-wing aircraft should be retained to distribute supplies to remote COPs that cannot be serviced by ground transportation, fixed-wing aircraft, or airdrops.

Regarding the second issue, responsive and reliable MCTS delivery requires an air scheduling system that incorporates rapid approval procedures and does not lead to excessive aircraft holds and procedural delays. The Army's use of direct support of its aviation assets that includes rotary-wing and fixed-wing aircraft, coupled with the Air Force's common-user, general support airlift approach, should provide the best chance for efficient airlift operations and successful ground operations. This observation is consistent with the findings of the 2008 *Quadren-*

[45] Tripp et al., 2006. Ideas include improving existing processes—for example, creating a dual-hatted deployment and distribution movement organization, implementing closed-loop planning and execution procedures, or developing new ways for utilizing the Air Force Air National Guard.

[46] The Army has an existing force structure for the C-23s, and the C-27Js will replace the C-23s. Consequently, this action has little or no impact on the existing Army Force Structure.

nial Roles and Missions Review Report on intratheater airlift assessment.[47] Direct support by resupply helicopters has proven to be successful in both Iraq and Afghanistan, even though the helicopters are being overused in Afghanistan.[48] Although the Air Force could alter its air tasking process so that its common-user aircraft could support MCTS shipments to ground forces, doing so would require a change in its intratheater distribution system from one based on airlift efficiency to one based on responsiveness.

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[47] The Defense Department concludes, ". . . joint force commander direct support airlift requirement for a theater of operations cannot be routinely satisfied through a common-user airlift service" (Department of Defense, 2009, p. 22).

[48] The Marine Corps also has direct control over its air assets. The Marine Corps operates in Marine Air Ground Task Forces (MAGTFs) that are supported by the Marine aviation combat elements. Marine Corps rotary-wing and fixed-wing aircraft are tailored to meet the level of assault support (combat or logistical) required by the MAGTF commander. The Aviation Combat Element provides direct support to the MAGTF in a manner similar to the way the Army operates its C-23s and CH-47s within the theater aviation brigade (Department of the Navy, Headquarters United States Marine Corps, *Assault Support*, Marine Corps Warfighting Publication MCWP 3-24, May 2004).

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